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THE FUTILITY OF THE CHINA WAR

JAPAN—A NATION OF IMITATORS?

FRANCE IN THE ORIENT

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ENGINEERING FINANCE COMMERCE

VOL. XXXIV SHANGHAI, JULY, 1938 No. 7

The Futility of the China War

A WHOLE year has passed since the Lukaochiao Incident of July 7, 1937, which plunged the two great Oriental powers into the existing titanic struggle, and still no sign of peace appears to be in sight. Last winter, after the fall of Nanking, Germany, through her representatives at Hankow and at Tokyo, made attempts to bring about peace discussions between the Chinese and the Japanese Governments. These efforts failed and doubtless other similar attempts, either by individuals or by States, have also produced no result. Recently the Peking Provisional Government in a Manifesto issued on June 15, 1938, just after the flooding of the Yellow River, condemned this desperate action of the Hankow Government as well as that Government's futile policy of prolonging resistance against Japan, and proposed a peaceful settlement of the Sino-Japanese conflict. In response to the Peking Manifesto a spokesman of the Hankow regime branded the Peking Provisional Government as a "puppet organization" having no status and not qualified to speak on questions pertaining to the present armed struggle.

Regarding the Peking Manifesto the leading British newspaper, the *North-China Daily News* of Shanghai, remarked editorially that this peace feeler of the Peking Provisional Government was doomed a failure from the outset, for, in the eyes of the recognized Government of China, it originated from nothing more than a rebel organization possessing no authority of its own and acting as emissary of the Power which openly has refused to have anything to do with General Chiang Kai-shek's administration. The proposal put forward in the Manifesto, in the opinion of the British newspaper, amounted to a demand that the Hankow Government should surrender itself to the Peking regime and submit to an organization having a name and form but no substance or real authority beyond the range of Japanese rifles. If any Power is to mediate in the controversy, the newspaper concluded, it can only do so between the recognized governments of China and Japan.

Obstacles Block Way to Peace

It has been disclosed also that the Hankow Government is in no mood to talk peace save on its own terms. This was made clear in statements of General Chiang Kai-shek and Mr. Wang Chung-hui, Foreign Minister at Hankow, in an interview of these officials with German journalists at Hankow. Not the least of the terms the Hankow Government would wish to put forward would be the complete withdrawal of Japanese from China and restoration to China of her complete integrity. Short of these things Chiang Kai-shek has let it be known he is determined to continue fighting either on the open field of by means of guerilla warfare—for years if necessary. In the interview Foreign Minister Wang Chung-hui emphasized, however, that some usefulness may be found in mediation by a third power, for in diplomatic language he implied that both nations desired to terminate hostilities, but neither would take the initiative for reasons of prestige. Thus the Peking *ballon d'essai* reveals only that after a year of destructive fighting Japan and China remain so far apart that talk of peace or mediation may only now be premature.

It may be appropriate to examine the whole situation realistically, and to ask if Japan and China must fight to the bitter end. Is it possible that the Japanese can be driven from China within a measurable period of time? Or, Will it be possible for Japan to conquer the whole of China after the Hankow regime removes to Szechuen and Yunnan? Must the horrors of modern warfare and the attendant widespread ruin and disaster continue until the Flowery Kingdom actually has been reduced to only "scorched earth?" Is not the welfare of the four hundred million of toiling masses, and the terrible sufferings of innocent women and children worth the most serious consideration of China's self-appointed leaders?

After a tragic twelve-month of war China has lost the richest and most populous ten of her twenty-two provinces, including the Imperial Capital of Peking and the National Capital of Nanking together with her great commercial and financial metropolis, Shanghai. Since the beginning of her intercourse with overseas powers through the past hundred years never has an alien army penetrated so far into the interior of Cathay and occupied so vast a part of her territory. The losses in blood and in treasure already is so tremendous and so incalculable that many decades must pass before the nation may be able to recuperate. According to the Hankow Government's own estimate not less than a hundred and fifty million Chinese have been adversely affected thus far by the hostilities and not less than thirty million refugees have been brought to the verge of starvation and need immediate relief, not to mention the hundreds of thousands of war casualties and civilian deaths. Estimates have been made that the property losses have reached the staggering total of thirty billion, probably about a third of China's total wealth. There has never been through the long centuries of Chinese history such a national disaster and such widespread destruction within the space of a single year. The Taiping revolution in the preceding century and the Manchu conquest in the seventeenth century extended over periods of from fifteen to twenty years.

The Power of Japanese Arms

As the *Shanghai Times* editorially has observed, the Japanese military machine has more than proved its ability to advance wherever it chooses to concentrate its forces. Even General Chiang Kai-shek himself admits the superiority of Japanese arms and so resorts to guerilla tactics, avoiding open battles in which even his central army is no match for the Japanese divisions.

It is the helpless Chinese masses that have had to endure the greatest suffering in consequence of guerilla warfare, as has been made apparent in Shansi, Hopei and in Kiangsu. General Chiang Kai-shek's avowed policy of continued resistance can only mean further and even more widespread ruination and increased suffering for the helpless people and in all parts of the country. It should be apparent that while a prolonged war perhaps may exhaust Japan, it is inevitable that it will first desolate all China, and quite literally speaking China may bleed to death. It is true that Japan is poor in natural resources, but it also is true that the natural resources of China are not plentiful. There can be no "final victory" as dreamed of by many Chinese patriots, even in the highly unlikely event that earlier Chinese hopes are realized and that some outside power may intervene at the eleventh hour. In the existing complicated international situation no likelihood is to be discerned that any outside power, not even Soviet Russia who professes to be China's best friend, is willing to risk a war with Japan—merely to help China. It should be plain now to any observer that Chiang Kai-shek cannot hope to drive the Japanese out of China by military

force, although he may be able in retreating to make defensive stands from time to time. The historic case of the successful Russian resistance to Napoleon in 1812, cited by so many Chinese writers of the present day, cannot be seen as a parallel with the present situation in China. The comparison is meaningless, for the times and, specially, the methods of warfare have changed. Russia is a cold bleak land in winter, remote from France and had England as an ally when Napoleon made his fateful march on Moscow. Climatic conditions of China are like those of Japan; Japan is in close proximity and, finally, China has found no ally to fight with her for a common cause. A sufficient number of Japanese troops, already co-operating on friendly terms with Chinese elements in occupied territories, could remain, permanently if necessary, on Chinese soil without danger from natural elements such as forced Napoleon into disasterous retreat.

History May Repeat

If Chiang Kai-shek and his Government withdraws after the fall of Hankow into Yunnan, as did Prince Kwei at the time of the southward march of the Manchus in the seventeenth century, he may suffer a fate similar to that of the last scion of the Ming dynasty. It is no mark of statesmanship for the leaders of a modern responsible government to refuse to end a war when reasonable hope of victory is gone. Further struggle means not only additional suffering for the people, and it also sharpens the severity of ultimate peace terms, as recently foreshadowed in a statement of the Japanese Foreign Minister, General Ugaki. Granting that peace terms must be disadvantageous to China, they may be preferable to annihilation of a large part of the entire population and desolation of the whole country. The truth has been proved of the old maxim, which is of Chinese Origin, that "between two evils it is wisdom to choose the lesser." Thus Hindenburg advised the Armistice in November 1918 as soon as the Allies thrust their forces to the German border. Lenin and Trotzky signed the Peace of Brest-Litvosk in 1917 when continued war could mean only further ruin and suffering for the Russian people. In spite of strong opposition of the Communes the French Government signed the humiliating Treaty of Paris in 1871 to end the disastrous Franco-Prussian war.

Japan repeatedly has declared she has no territorial ambition in China, but desires only economic co-operation on a basis mutually beneficial. In view of the general situation throughout the world and, especially by reason of the thrust of communism into the Far East in recent years, China and Japan, being of the same race and culture should, in spite of differences of viewpoint in some things, co-operate instead of antagonizing each other. A bitter struggle in the form of a long war can only result in vast losses to both countries, wrecking the livelihood both of the Chinese coolie and the Japanese peasant and weakening the power of the Orient as a whole.

Peace and conciliation, even as proposed by an unrecognized authority like the Peking Provisional Government, should not be slighted and ignored, for such proposals may reflect the opinion of millions of peace-loving Chinese who have not been allowed freedom of speech under rule of the Kuomingtang. If the declaration of the Peking Provisional Government is not to be considered simply because of the legality and constitutionality of that regime, it may properly be asked what is the nature and status of the Hankow National Government. By what right, legal or moral, is Chiang Kai-shek entitled to continue a hopeless war and prolong the sufferings of the Chinese people? It may not be gainsaid; in truth, it is admitted, that China, although a Republic in name through the past decade has been ruled—under the pretence of tutelage of the people—by the Kuomingtang party, ruled by autocratic, even despotic methods, there being no parliament or representative organ elected by the people at large as must be the case in a true republic.

When a Republic is not a Republic

The Hankow National Government, as was the Nanking National Government before it, with General Chiang Kai-shek as its dictator, is a curious hybrid combination of Kuomingtang bureaucracy, Bolshevik despotism and military autocracy. No freedom of speech has been permitted to conflict with Kuomingtang propaganda which hitherto has held monopolistic control of press and radio to sway the public mind with narrow nationalism and hatred of the Japanese neighbor power. Chiang Kai-shek did not consult the wishes of the Chinese people when he went to war with Japan. The Chinese masses simply had to submit as a matter of fate. The old political parties like the Anfuites and the Peiyang clique never gave either support or approval to the course Chiang Kai-shek elected to steer; they silently observed the march of events. Only the communists, with ulterior motives and sinister designs made in Moscow, co-operated with the Kuomingtang to bring about war with Japan.

From the viewpoint of a Chinese constitutionalist the Kuomingtang regime is only a revolutionary government maintained by the military force of Chiang Kai-shek's army, but not elected by the Chinese people as the government of a Republic should be. Since 1927 when General Chiang Kai-shek in his northward expedition captured Nanking and Peking the old constitutional government of the Republic of China has been overthrown and replaced by the Kuomingtang party, which simply set aside the old constitution and permitted no parliament or representative organ of the people to exist. As soon as Kuomingtang military forces had been driven away from Peking and Nanking, new governments were easily set up by Chinese politicians who had never espoused Kuomingtang policies and these, of course, have had Japanese encouragement.

Chiang Kai-shek undoubtedly realized his chief political weakness and he hastened, therefore, to convoke, on July 7, 1938, the National Advisory Council in order to camouflage his own constitutional position and augment the authority of his Hankow Government. The Council's two hundred-odd members, however, were not elected by the people, but were nominated by the National Government on recommendation of provisional and party authorities. They cannot be regarded, therefore, as popularly elected representatives of the people, nor do they possess the authority to decide for war or for peace. The convocation of the National Advisory Council does not alter the fact that General Chiang's regime is not a representative government of the Chinese people, but is simply the political bureau of the Kuomingtang, having no real constitutional basis. In unduly prolonging the war, Chiang Kai-shek has no mandate from the four hundred million Chinese citizens whom he professes to represent, but only from the Kuomingtang party—his own creation. According to strict legalities, if the Peking Provisional Government has no right to demand peace, neither has the Hankow Government the right to continue the war. The sovereign Chinese citizens have been consulted by neither regime.

Some Possibilities Presented

It is true that the Japanese Government has declared through Prince Konoye that it will not deal further with Chiang Kai-shek's administration, but it was reported later that the Tokyo Foreign Office under General Ugaki still recognized the existence of the Hankow regime. The Manifesto of the Peking Provisional Government suggested, among other things, the retirement of Chiang Kai-shek together with his henchmen and invited older and more moderate members of the National Government to come out openly for peace negotiations. An amalgamation of the three governments, at Hankow, Nanking and Peking—after the elimination of Chiang Kai-shek—to form a united central Government of China is being discussed by a number of Chinese leaders, according to reliable information.

As a foreign writer under the name of Joe Toc Toque argued in the *North-China Daily News* recently, Why cannot Chiang Kai-shek resign and avoid further ruin and suffering to his people? Indeed, it would seem that if the peace terms of Japan can be made lighter thereby, it is Chiang kai-shek's patriotic duty to give way to peace and conciliation between the two great nations of the Orient. Otherwise Chiang Kai-shek and his henchmen are merely fighting to retain their own political power, as alleged in a Manifesto issued in Nanking, and not for the welfare of the Chinese people. Chinese patriots are to be found who assert bluntly that Chiang Kai-shek has no right to persist in this hopeless and needless struggle which his erroneous policy has brought about. It is held that politically he should be held responsible, as would be the case in a democratic country, for the misfortune and catastrophe to his follow citizens. General Chiang and those responsible for the war

(*Continued on page 248*)

America's Philippine Contributions

*By Hon. GEORGE A. MALCOLM**

FOR nearly four centuries the people of the Philippines Archipelago have had contacts with the continent of North America. In early days Spanish galleons sailed back and forth from Mexico and the Philippine Islands carrying human and commercial freight. Later when the port of Manila was opened to commerce by the Spanish Government, Yankee merchants became associated with Philippine trade with such success that in 1859 it was reported the United States occupied the first place among the foreign merchants and handled more than a third of the total value of exports. However, it has been during the period which began with Dewey's victory in Manila Bay on May 1, 1898, and extended to the present that the influence of the United States of America has been most felt in the Philippines.

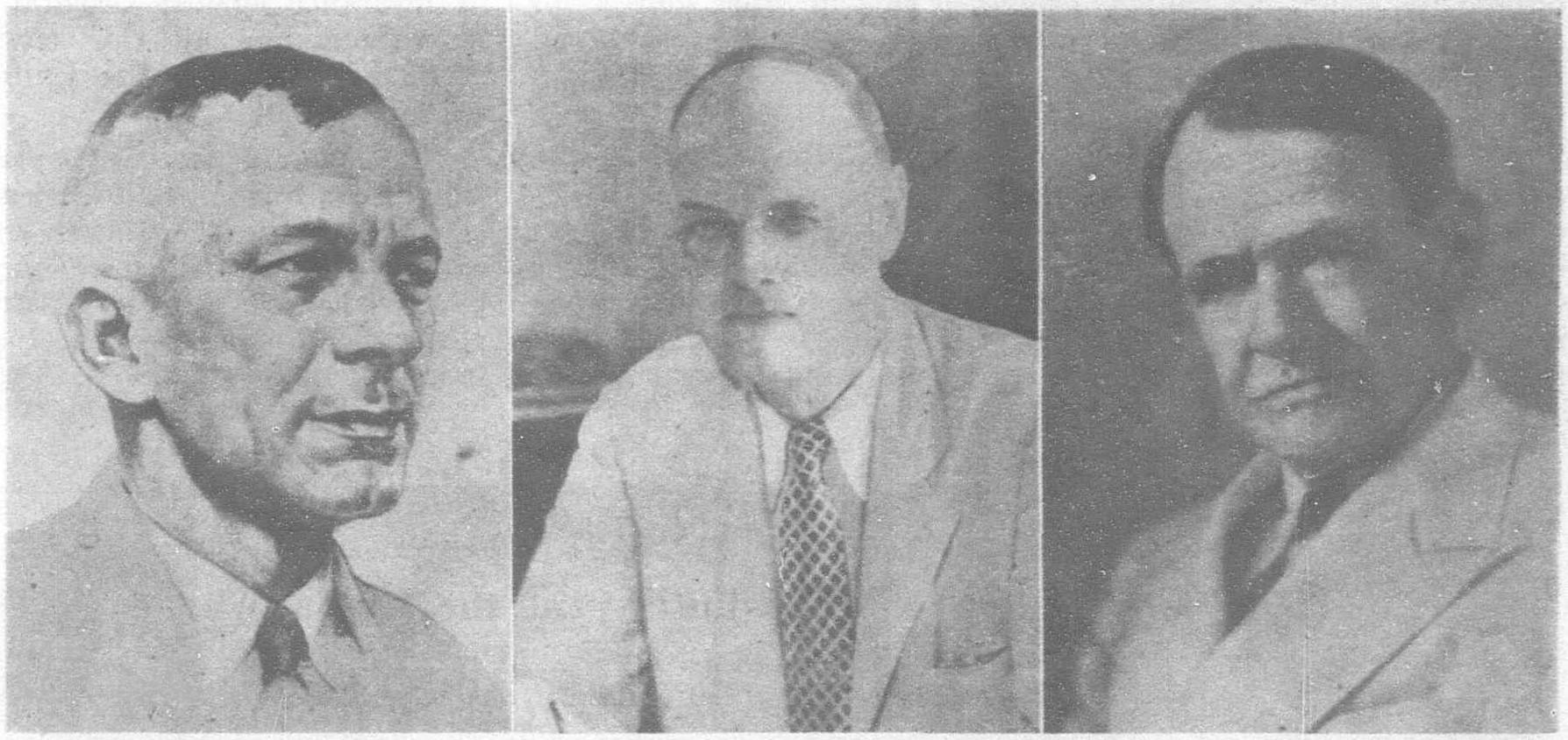
It is the aim of this article to present a brief inventory in realistic form of the contributions of the American people to the Filipino people.

A government may be one of laws, but fundamentally it is the character of the men who administer the government that determines its success. The United States and the Philippines alike have been fortunate in the type of officials selected by the United States Government to assist in establishing and administering the Philippine Government. From William Howard Taft, the first Civil Governor who inaugurated the new regime, to Paul V. McNutt, the present High Commissioner who so capably assists in shaping the policy of the United States, American officers in authority have been guided by intelligent decisions and sympathetic understanding. Of Americans who occupied executive positions, it may be said of them that with few exceptions they were high grade public officials. They were the conscientious civil servants who organized and administered the educational system, the health service, the constabulary, and the public works and other bureaus and offices. Not specially trained for colonial service, these Americans, nevertheless, displayed particular aptitude to get along with the Filipinos and to give full measure of accomplishment in the performance of difficult tasks.

American policy, whether rightly or wrongly, has fairly consistently had as its goal the eventual proclaiming of complete independence for the Filipino people. A corollary of that policy has meant the preparation of the people for future independence and the recognition of self-government by the people, with one step leading to another step, each progressively nearing more complete control of local affairs by the elective representatives of the Filipino people. At present the Commonwealth of the Philippines is in existence and is in nature a ten-year transition form of government which began on November 15, 1935 and will end on July 4, 1946. On this latter date, if nothing unforeseen intervenes, the Republic of the Philippines will be proclaimed and American sovereignty withdrawn from the Islands. This action, it should be explained, was taken by the Congress of the United States with the approval of the American President and was accepted by the Philippines Legislature and the Filipino people.

American policy has permitted the inauguration of democratic institutions in the Philippines. Local governments were first given into the hands of the people. Next the legislative department was partly Filipinized and eventually entirely Filipinized. In the judicial department Filipinos were named to the justice of the peace courts, the trial courts, and the Supreme Court with the Chief Justice even from the beginning being a Filipino. With the institution of the Commonwealth of the Philippines the Filipino people took over the entire governmental structure—legislative, executive, and judicial—with a president, Manuel L. Quezon, elected by them by direct vote to be their official representative and leader. The government thus established has been pursuant to the desires of the people, as expressed through delegates, who in a constitutional convention approved a constitution, later confirmed by the President of the United States as complying with the enabling act and accepted by the electorate by direct vote. American authority is maintained through a United States High Commissioner who is the representative of the President of the United States, recognized as such by the President of the Philippines and other officials in the Islands.

It is impracticable even to mention American accomplishments in the Philippines. Nevertheless, a few topics are so outstanding they cannot be omitted.



Three Prominent Americans in the Philippines. Hon. Arthur F. Fischer *(left)* and Dr. Frederic C. Howe *(right)*, Technical and Economic Advisers to President Manuel L. Quezon. *(center)* Former Philippine Supreme Court Justice George A. Malcolm, Adviser to the United States High Commissioner, Paul V. McNutt

Educational System

An educational system was established which furnished millions of Filipino children with chances to obtain an education. This system extends through primary, intermediate, and high schools and universities to professional degrees. All courses are conducted in the English language which is gradually becoming more widely used than Spanish, but which has not overcome to any appreciable extent the use of the vernacular.

Similarly the improvement of health and sanitation has been notable. Efficient health and quarantine services were established. Smallpox and cholera were practically stamped out. The lepers were isolated and cared for, and the insane were afforded considerate treatment. Hospital facilities were made available. The triumph of medical science over disease was as complete in the Philippines as it was in the construction of the Panama Canal or anywhere within the confines of continental United States.

Philippine defense has been exclusively confided to the United States Army and Navy. An important branch of the Army has been the Filipino Scouts who have made dependable soldiers.

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* Member of the Staff of the United States High Commissioner to the Philippines and former Senior Justice of the Philippine Supreme Court. Justice Malcolm's latest book is "The Commonwealth of the Philippines" (1936). This article appeared in *Pan-Pacific*.

Public order was until recently maintained by the Philippine Constabulary and the municipal police. Beginning with the inauguration of the Commonwealth of the Philippines national preparedness for defense has been given a decided impetus. A Philippine Army has been organized by the President of the Philippines as commander-in-chief. He has had the benefit of the advice of General Douglas MacArthur, former Chief of Staff of the United States Army, and other experienced army officers. The army thus created has taken over the Philippine Constabulary and has been supplemented by a national police system which has succeeded miscellaneous municipal police forces. The ability of either the United States or the Philippines or the two countries jointly to defend the Islands from outside attack has been much debated and cannot be conclusively settled except in the arena of war. Envisioned, however, is a citizen trained reserve army large enough to make an invasion of the Philippines an expensive and difficult proposition.

The Financial System

The United States gave the Philippines an excellent financial system. The finances are sound. The entire cost of civil administration is borne locally. The budget system was established in the Philippines before it was in the United States. The Philippine budget has been and is balanced. The national debt is a mere trifle in comparison with the enormous debt loads which other peoples must carry. Given the assurance of the income now received, the government will have sufficient funds at its command to meet ordinary expenditures, but will have to look to other sources for money to meet extraordinary expenditures.

America has contributed largely to progress in the Philippines by throwing open the American market to Philippine exports. This has meant increased prosperity for the people of the Philippines and a higher standard of living for them. On the other hand, it has meant for the people dependence on the American market, a dependence not assured following the establishment of the Philippine Republic. This economic conundrum is the one which now puzzles statesmen, American and Filipino. Granted that the Philippines should and will be made independent on or before 1946, how can the economy of the people be planned so as to support an independent government, to afford the people modest sums to meet the family budget, and to keep under control the rising tide of discontent caused by miserable living conditions.

As was to be expected, dark spots appeared in the American record in the Philippines. Occasionally untried men when placed in responsible positions went wrong. Mistakes of commission and omission were made. Injustices and wrongs were perpetrated. All this is true. Yet giving due allowance for American errors the regime established was the best the Philippines had ever known, did not suffer by comparison with the administrations of neighboring colonies, and was as harmoniously and efficiently administered as any state within the United States.

Uncertainty of Policy

The extent of American influence on the Filipino people in the future is not for mortal men to prophesy. Uncertainty in the present as in the past plagues America's policy in the Philippines. The recommendations of the Joint American-Filipino Preparatory Committee on Philippine Affairs remain to be formulated, and thereafter must run the gauntlet of presidential consideration and congressional action. A hastened independence has been broached by the Filipino president. A dominion status has been hinted. Commercial pacts between the United States and the Philippines require careful handling before signatures are attached. The kind of insurance against Oriental risks must be determined. Yet notwithstanding all this confusion of thought some sort of relationship between the United States and the Philippines will exist for decades.

The usual formula in a platform is "We take pride." Truthfully it can be said the American people can take just pride in their contributions to the welfare and happiness of the Filipino people, contributions which have raised a splendid race from one of dependence to equals, constituting a self-respecting and self-governing Commonwealth expected soon to emerge into an independent state.

The Futility of the China War

(*Continued from page 246*)

should not be permitted to stand in the way of Sino-Japanese conciliation and peace in Eastern Asia.

Wisdom, prudence and common-sense certainly require the Chinese leaders, if they are mindful of the welfare of their people, carefully to exploit every possibility of ending this futile struggle; and far-sighted statesmanship will counsel generosity, leniency and moderation on the part of the Japanese Government. General Itagaki, Japanese Minister of War, asserted recently that Japan should be prepared to fight for ten years, but assuredly both Japanese and Chinese leaders hope this will not come to pass. The wiser statesmen of these two brotherly nations doubtless will do all in their power to avoid the weary path of exhaustion and immolation. Although anti-Japonism and communism must be eradicated from China, the territorial integrity and political unity of the country should be preserved. As Dr. Wang Chung-hui said, China is prepared to co-operate with Japan on terms of equality and reciprocity—echoing statements that Japanese leaders made earlier at Tokyo—and the Chinese nation is not inspired with hostility against Japan. What can be the use of wasting more blood and treasure fighting if co-existence and co-prosperity can be made possible for both countries?

Essentials in the Situation

Bismark's generosity toward Austria in the peace of Sadowa in 1866 certainly won over the friendship of Austria and made possible the dual alliance of these Germanic powers. England's leniency toward France at the Congress of Vienna in 1815 made an ally of France for England in the Crimean war of 1854 and again in the World War this alliance became a decisive factor. If constant and hearty co-operation are desired between China and Japan to work out the destiny of Asia, as advocated by Mr. Yosuke Matsuoka, Japan must be moderate and generous. A peace with honor to both Japan and China is the best guarantee for permanent peace in the Far East. Japan in order to maintain herself as a first-class power and be the stabilizing force in Eastern Asia can ill afford to dissipate her whole energy in crushing China, nor is it to her advantage to allow the war to drag on so as to engender a feeling of lasting animosity between the two Oriental peoples who have common interests in the modern world. There can be nothing to gain but everything to lose, if both fight to the bitter end. Besides, prolongation of the war will only weaken the two Oriental nations and play into the hands of the Comintern which looms as a dark menace over both China and Japan.

Just as the Yellow River flood has brought a pause to hostile operations in the North, and wet weather incidentally is impeding military activities along the Yangtze, Providence, perhaps, intends to call a halt to the needless struggle and to hasten the coming together of the two nations to reconsider possibilities of adjusting their differences by peaceful means. It is a classical Chinese belief that "Heaven sees what the people see; Heaven hears what the people hear, and Heaven wishes what the people wish." On the eve of the struggle for the possession of Hankow, which must mean further enormous sacrifice for both armies, is it not opportune for both sides to make a survey of the whole scene, to face the grim realities and to strive to discover a way back to Peace?

Japan—A Nation of Imitators?*

COMMENTS have sometimes been made that the Japanese have hardly contributed anything worthwhile to world inventions—such as steam engines, electric trains, airplanes, etc. It is also said that the Japanese lack originality; that they are good only at copying what has already been accomplished by Occidental peoples.

A study of history reveals, however, that Japan produced many distinguished inventors in the old days, but that hardly any of them were given a full opportunity to accomplish any great work, until in recent decades. Far from encouraging them, the then reigning authorities invariably oppressed the inventors of bygone days, many having been killed, simply due to the officials' feudal narrow-mindedness. Not only the social and political situations, but also the geographical conditions of Japan were not favorable for inventors, either, as it will be made clear later on.

The Japanese as a race, however, seem to be just as good as any Occidental peoples where the brainwork is concerned, as it may be illustrated by some remarkable examples:

In ancient days, the bow and arrow was the principal battle implement, and the old Japanese bow reveals that ingenious application of dynamic theory is made in strengthening the structure of this weapon. During and after the Kamakura period, amazing development was made by the technique of tempering steel to make excellent swords, the like of which can never be reproduced to-day.

Later in the Tokugawa Shogunate era, still greater inventions were made, included among these being Jozo Yoshio's detonator, Kyosuke Katai's breech-loading gun, and Ikkansai Kunitomo's air-gun. Kowa Seki is noted for his advanced mathematics.

Gen-nai Hiraga, of Sanuki province, completed an electrical device in seven years, and the identical invention was made abroad after three generations of concentrated research work. Zozan Sakuma invented electric battery which was later found to be identical in composition with that of the Daniel battery. Naosuke Nakahara and Juzaemon Ujuku, of Kagoshima, invented telegraphic apparatus. All of these inventions are original work, none of them having been introduced in this country in those days by the then visiting foreigners.

Aviation Old Story to Japan

Goryu Asada meanwhile advanced the heliocentric theory in contradiction to the ptolemaic theory.

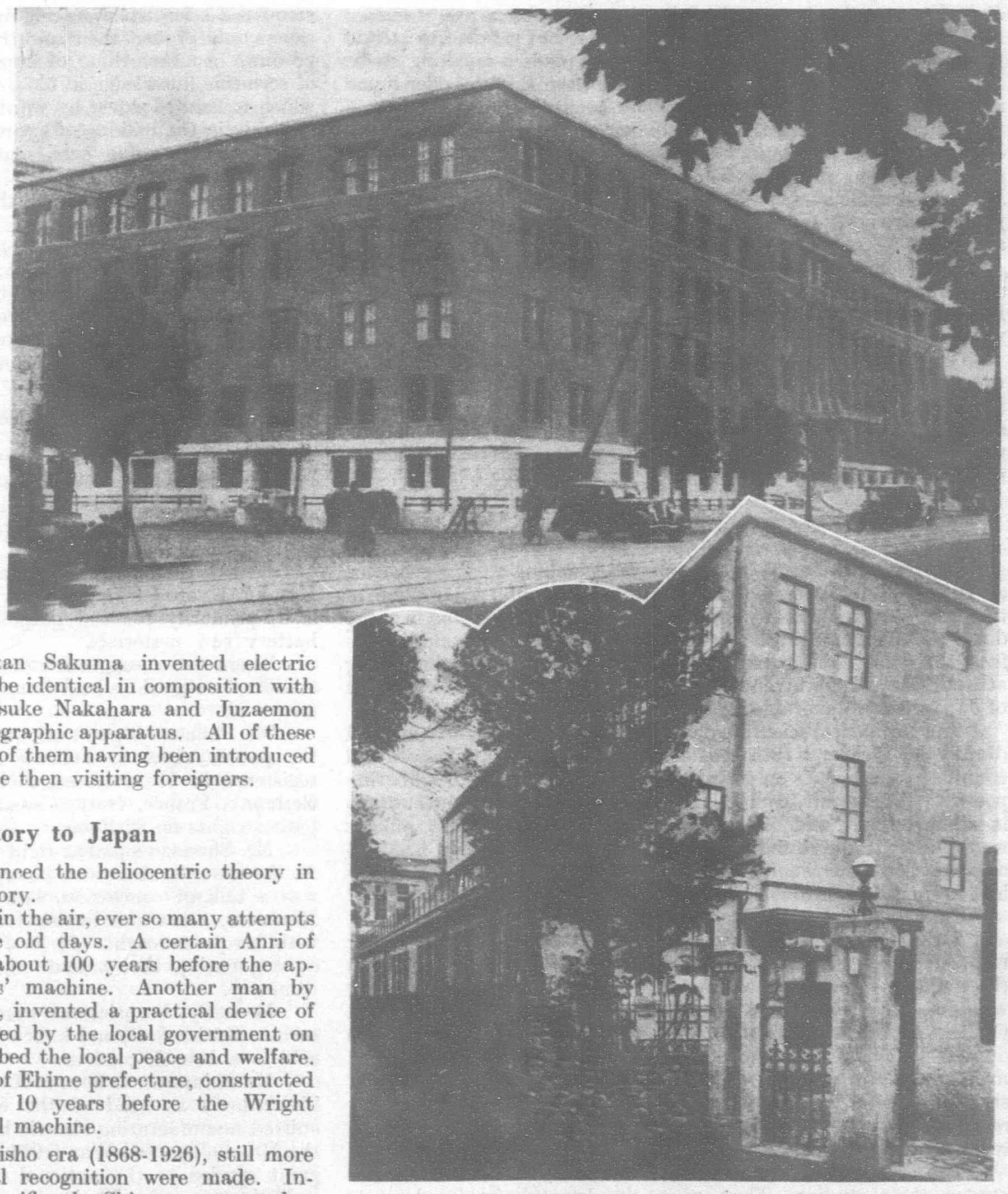
As for the aspirations for flying in the air, ever so many attempts were made in this country in the old days. A certain Anri of Ryukyu island invented a plane about 100 years before the appearance of the Wright Brothers' machine. Another man by the name of Kokichi, of Okayama, invented a practical device of his own, but his machine was seized by the local government on the ground that the monster disturbed the local peace and welfare. Furthermore, Chuhachi Ninomiya, of Ehime prefecture, constructed a propeller-driven airplane about 10 years before the Wright brothers made their first successful machine.

During and after the Meiji-Taisho era (1868-1926), still more inventions worthy of international recognition were made. Included among these are the Murata rifle, the Shimose gun-powder, Toyoda automatic looms, the Okui dry battery, Dr. Takamine's adrenalin, Umetaro Suzuki's vitamine, Genzo Shimazu's white lead manufacturing process, Kokichi Mikimoto's cultured pearl farming, and so on. And to-day, still more inventions of greater magnitude are on the way of perfection or already in the process of practical appliances.

That Japan to-day is behind none of the advanced countries of the world in the domain of academic research work will be seen by a little episode which was incidentally brought to light at the time of the Pan-Pacific academic conference in Tokyo in October, 1930. Dr. Baron Chusaburo Shiba, member of the committee of the conference, revealed the following fact at the time of the conference:

"The essays and theses submitted to the Pan-Pacific conference numbered more than 400. As it was difficult to study all of them at the conference in consideration of the limited time

*From *Osaka Mainichi*.



Japan's aid to Inventors—*(Above)* Tokyo Patent Bureau *(Below)* Teikoku Hatsumei Kyokai Laboratory, Tokyo

available for the gathering, they were classified into two groups. One group was to be read at the conference, and the other was to be made public in print. Since the conference was sponsored in Japan, we proposed to discuss as many essays and theses presented by foreigners at the conference as possible. As we sorted out the documents, we found that the Japanese works were by far superior to most of the foreign contributions. As a result, the Japanese academic circles had the sway over almost all the branches of the discussions at the conference. Foreign visitors were then given opportunity to inspect the equipment and facilities of the Japanese research stations and factories, and they were much impressed by the progress that Japan had made. As a matter of fact, a certain American scholar asked me to make arrangements so that he might study at a Japanese research station for several years."

No More Blind Worship

Japan has apparently passed the period of blind worship of everything that is foreign, as was evidenced during the Meiji Era (1868-1912); Japan has passed the period of scrutinizing the western culture during the Taisho Era (1912-1926). And Japan has entered the period of establishing the original culture of Nippon to-day.

That Japan worshipped everything that is foreign during the Meiji Era may be seen by the following examples:

Jiro Miyahara invented the tube boiler, but it failed to attract public attention; on the contrary, he was made a laughing stock. When his system was taken up in Britain, the British boiler found its way all over the world, eventually coming to Japan.

Chuhachi Ninomiya was a soldier at the time of the Sino-Japanese War (1894-5). His invention of propeller-driven airplane, made 10 years before the appearance of the Wright Brothers' machine, was rejected by his superior officer. Thirty years afterward, Japan had to pay good prices to buy foreign airplanes.

Umekichi Takamatsu invented the caterpiller tank. The then war authorities of Japan considered it worthless. When the British adopted the system for their war tank, it surprised the world.

There are still more similar examples: Japan was in a period when nothing was worthy unless it was imported from an advanced foreign country. It was the same as a product made in a provincial region. It was of hardly any market value unless the same article was handled by influential firm of a large city, carrying the trade-mark of the company.

Situation in Feudal Days

The Japanese as a race are capable of making great inventions, as is proved by moth-eaten historical documents. But none of them have turned out any invention of international fame in those days. The fundamental reasons for the failure is found in the fact that the then government authorities assumed the wrong attitude toward the inventors, and that the geographical condition of Japan was unfavorable for scientific development.

The Occidental scientific development was particularly marked during the 17th and 18th centuries. In those days, the powerful countries were always on guard against the invasion of neighboring powers. As a result, competition was keen among these countries in all directions, and distinguished scientists and brainy officers were highly appreciated. Japan, on the other hand, had no apprehension regarding invasion from outside powers, as the country had been isolated from the continent.

Take such prominent warrior-rulers as Yoritomo, Hideyoshi, and Ieyasu. Their concern was limited only to the welfare of their respective descendants regarding the possibility of uprisings within the country. Even if there appeared talented scientists or superior warriors, these rulers had no intention to appreciate the merit. On the contrary, these super-men were invariably subjected to oppression by the rulers who feared that these distinguished men might take the place of their respective descendants. Many of these great men were killed before they had accomplished anything really great enough. Any source of future trouble had to be removed before it was too late.

The scientists in Japan in those days, too, were not allowed to pursue their studies. They were simply undesirable elements likely to disturb the public order and welfare or else likely to incite mutiny. And so they had to be disposed of in one way or another.

There were ever so many talented men who were put to severe punishment because they attempted to produce flying devices. Not only the flying device, but anything unusual was banned.

Another remarkable instance will be cited: The noted castle of Kanazawa was erected under the reign of Lord Toshinaga Maeda. The castle stands at an elevated edge of a mountain, and it is difficult to obtain water. For the water had to be led to the castle from the upper stream of the Sai-kawa across hills and valleys. Then there was a retainer by the name of Shirobei Itaya who worked out the "U" shape water main on the theory of the syphone. Itaya's invention solved the difficulty much to the happiness of the Maeda clan. Nevertheless, when the work was accomplished, he was put to death by his Lord who was afraid that a man like this might cause trouble in the future. If he were permitted to continue his study, he might have invented the hydraulic pressure apparatus and many other useful devices.

Afraid of Inventors

So the noted scientists and inventors were invariably executed by the rulers who were afraid of them. Whereas in Occidental countries, scientists were highly appreciated because their inventions could protect their country from the invasion of neighboring powers. Another thing of importance that prevented the spread of scientific knowledge in old Japan is the custom of family secret which is handed down by word of mouth. This tradition existed not only in the making of swords, guns, medicine, etc., but also in the domain of fine arts, and the secrets have been jealously guarded.

The heart of things in all the lines of manufacturing industries in those days was kept a secret. The product, manufactured on the basis of the secret, was put on the market, and in it was contained the very secret. But the secret principles were kept from outsiders. And this custom has prevented the scientific developments in Japan from making any marked progress for many years. For inventions are made stage by stage, through introduction of various new devices, by the succeeding technicians.

Some Japanese Contributions

If you've thought of Japan as a race of imitators, consider, then, a few of her contributions to the world of science and industry:

White Lead

Genzo Shimazu, On-Ike-agaru, Higashi Toin-dori, Kami-Kyo-ku, Kyoto (city), perfected the process of manufacturing white lead, primarily for the purpose of obtaining the self-supply of battery raw materials.

There was a suggestion of purchasing the patented process of manufacturing white lead from Germany, but the price asked was too much.

Mr. Shimazu began work on his invention in 1918, and acquired the patent right in February, 1923, which was subsequently registered in 11 countries, including Britain, the United States, Germany, France, Italy, Canada, etc. His inventions have won patent rights on 82 items.

Mr. Shimazu's patent right was sold to the U.S.L. Co. in 1933. At the time the American patent right was obtained in 1926, there was a talk of concession, but the negotiations ended in failure. Moreover, a law suit lasting for five years followed in connection with his patent right. It finally closed in favor of Mr. Shimazu. Subsequently, the patent right was sold to the American company.

Recently, negotiations were concluded to sell the right to a certain British firm, and indications are that the same right will be sold to a French concern.

Mr. Shimazu was born in Kyoto in 1869. In 1894, he succeeded his father's as head of the Shimazu Engineering Works. He started manufacturing electric batteries in or about 1897. During the Russo-Japanese War (1904-5), the Shimazu battery proved of great service to the national defense, and he was subsequently publicly honored. He has received many medals, trophies, and prizes from various sources for his inventions. In 1930, he was

furthermore honored with the Imperial invitation to a banquet as one of the 10 distinguished inventors of the Empire.

Boiler

Tsunekichi Takuma, of No. 15, Oishi, Saigo-machi-no-uchi, Muko-gun, Hyogo Prefecture, started working on his boiler invention in 1909 and obtained the patent right in 1913, but it was after the World War that his boilers came to be widely recognized for their originality and superiority.

Mr. Takuma was born in Higashiso-mura, Tohaku-gun, Tottori Prefecture, in 1872. He studied first at the private school of his own father and then at the Hirotani Kogaku-juku. He went to Kyoto at the age of 13 and became an apprentice and errand boy of a practising physician. His life was full of ups and downs. When he started working on his boiler invention, he had hardly any systematic training in engineering. His boiler, nevertheless, is given international recognition to-day.

Piston Ring

Dr. Viscount Masatoshi Okouchi, of Shimizumachi, Yanaka, Shitaya-ku, Tokyo, invented a piston ring which produces even pressure on the internal wall of cylinder, under the joint auspices of Dr. Keikichi Ebihara, in 1923.

This piston ring was produced at the Rikagaku Kenkyujo (the physical and chemical research institute) of Tokyo as an experiment and was later manufactured on a commercial basis by the Riken Piston Ring Co., Ltd.

Dr. Okouchi was born in 1878. He studied at the arms section of the engineering college of the Tokyo Imperial University. After being graduated in 1903, he was appointed an assistant professor of the university. He went to Germany in 1908 to study the manufacture of arms and returned in 1911. He was then appointed a professor of the Tokyo Imperial University. The degree of Doctor of Engineering was conferred on him in 1914. He was appointed head of the Rikagaku Kenkyujo in 1921, and has remained in this post to this day. He was publicly honored by the Imperial Invention Association in 1933.

Dr. Keikichi Ebihara, who assisted Dr. Okouchi in his invention of the piston ring, was born in 1898. He was graduated from the machinery section of the Tokyo higher technical school in 1919, and from the physics department of the Tohoku Imperial University in 1923. He entered the Rikagaku Kenkyujo immediately after the completion of his studies. The degree of Doctor of Engineering was conferred upon him in 1928. He was subsequently appointed an assistant professor of the Tohoku University. In 1932, he was ordered to study in Germany on machinery manufacturing, returning to Japan in April, 1934. Dr. Ebihara was honored by the Imperial Invention Association same as Dr. Okouchi.

Permanent Magnet

Dr. Kotaro Honda, of Kanoko Shimizu, Sendai, invented the permanent magnet, in 1916, with the scholarship granted by Baron Kichizaemon Sumitomo. In memory of the assistance given by Baron Sumitomo, the permanent magnet was named K.S. steel.

K.S. steel is expensive, costing about seven times more than the Tungsten magnet, mainly because of its using cobalt as part of the raw material. Despite the high price, however, it has become an indispensable material for advanced apparatus. The patent right has been sold to the Western Electric Co. and the General Electric Co. The American companies use the permanent magnet for telephone receivers which can be made smaller when using K.S. steel.

Dr. Honda was born in Hekikai-gun, Aichi Prefecture, in 1870. He was graduated from the physics department of the Tokyo Imperial University in 1879. Five years later, he was granted the degree of Doctor of Physics. He studied abroad from 1889 until 1901. On his return to Japan, he was appointed a professor of the Tohoku Imperial University in Sendai. When the Iron Ores Research Institute was created within the Tohoku Imperial University, Dr. Honda was appointed the head thereof. This institute was later reorganized into the metallic research institute with Dr. Honda remaining as its head. Dr. Honda was appointed president of the Tohoku Imperial University in 1931, which position he still holds.

Dr. Honda has received academic medals and awards from various quarters not only in Japan but also in foreign countries in recognition of his distinguished work accomplished in the domain of improvement in iron and steel manufacturing.

Telephoto

Dr. Yasujiro Niwa of Tokyo started working on his invention of telephoto in about 1926. In February, 1928, he completed his first model which was subsequently operated in the presence of government officials and others. Dr. Niwa then began to make a more simplified model for practical use, and official experiments with this model were conducted between Tokyo and Osaka in August, 1928. This apparatus was then put into practical use by the *Osaka Mainichi* and the Tokyo *Nichi Nichi* between Osaka and Tokyo on the occasion of the Imperial Accession of H.M. the Emperor in October, 1928. The Dr. Niwa's system was adopted by the Communications Office in August, 1930, to handle the public telephoto service between Tokyo and Osaka.

Dr. Niwa in 1929 was granted a subsidy by the Commerce Office to conduct research work on the wireless telephoto apparatus. He conducted his first experiment between Tokyo and Shizuoka, and between Tokyo and Ito in December, 1929. Other experiments by short wave were made between Tokyo and Osaka in January, 1931. All of these experiments proved successful.

Dr. Niwa has also produced a more simplified model of his telephoto apparatus. According to this new device, the facsimile of photographs and documents can be transmitted directly, instead of on photographic films. It saves the trouble of development and printing. A wireless experiment on this simplified device was conducted between Tokyo and Ito in December, 1931.

Dr. Niwa's telephoto system is used not only in Japan, but also in Britain, France, and Manchoukuo.

Dr. Niwa was granted an award from the Imperial Invention Association in 1933 out of the Imperial encouragement fund.

Television

Professor Kenjiro Takayanagi, of the Hamamatsu higher technical school, Hamamatsu, Shizuoka Prefecture, started research work on the television apparatus in 1922. Later he was given the assistance of Professor Tomomasa Nakajima, his colleague at the school.

In 1928, he succeeded in transmitting the image of a person. When he completed the Brown tube for a wider field of television in May, 1930, he was honored with the Imperial visit of H.M. the Emperor. Further substantial improvements have been introduced to-day.

Professor Takayanagi was born in 1899. He studied at the electric course of the industrial normal section of the Tokyo higher technical school, and became an instructor of the Kanagawa prefectural industrial school, lecturer of the Hamamatsu higher technical school, and later a professor of the latter. He is at present on a tour abroad to study television in other countries.

By way of encouragement of his research work, Professor Takayanagi has received monetary subsidy from various quarters over a number of occasions.

Culture Pearls

Kokichi Mikimoto, of Ginza 4-chome, Kyobashi-ku, Tokyo, started the culture of pearls in 1890 at Ago Bay, Shima-gun, Mie Prefecture. He met with immense difficulties in the early stage of his enterprise. In about 1894, however, his enterprise began to make good progress, and he obtained the patent for his culture system in January, 1896. After 17 years of subsequent research work, he succeeded in producing round culture pearls.

Mr. Mikimoto at present runs his culture pearl enterprise at six places in Mie Prefecture, and one place each in Nagasaki, Wakayama, and Okinawa Prefecture, and another place at Parao island of the mandated South Seas Islands. The sea ground covered by his culture pearl enterprise extends to about 4½ acres ; Approximately 3,000,000 oysters are newly supplied to culture pearls, and the pearls thus obtained are estimated to be worth Y.3,000,000.

Mr. Mikimoto was born in Tobamachi, Mie Prefecture, 1858. Following his accomplishment of the invention to produce culture pearls, he has been publicly honored on a number of occasions. He was made a member of the House of Peers in 1926 by the Imperial appointment in recognition of his service to the country. He was also included among the 10 distinguished inventors who were invited to the Imperial banquet in 1930.

France in the Orient

By MASANAO INOUYE in the Osaka Mainichi

At the time when we hear persistent reports that France is helping China fight Japan by supplying arms and ammunition to her or by enabling her to secure war materials through French Indo-China, it will be interesting to know how France came to take possession of her colony in East Asia which originally belonged to China, thus acquiring a foothold in this part of the world. We often hear Britain criticized for her imperialistic policy in the Asiatic continent, but we seldom hear France made a target of criticism for her past aggression in Asia.

Within the past century, Britain took Hongkong, Upper and Lower Burma, and obtained vast spheres of influence commercially and industrially in China, while France wrested Cochin-China from her, gradually extending indefinite spheres of influence into the provinces of Yunnan and Kwangsi, and the island of Hainan. Britain almost always took the lead in the game of colony-snatching and was signally successful all round, as the coloring of the world map shows.

It was when she had an eye on East Asia and was dispatching so-called punitive expeditions that France followed suit. Sometimes singly, but mostly in collaboration with Britain, though playing a minor part, France succeeded in acquiring a large area of land from China.

How she worked together with Britain and what were their relations, can be seen from the quotations given hereinafter from authentic sources. They eloquently tell us what France did herself years ago in China.

In this connection, it is only fair to say that oppression of the weak by the strong was the order of those days, as it is in these days. The strong may not directly use force, which is after all poor strategy; but they do so by diplomatic maneuvering backed by heavily armed land, sea, and air forces, by their gigantic programs of armaments, and by threatening to cut others' economic and political lives by the sheer force of accumulated wealth and natural resources which they have gained by blood-stained hands. So France did just what others did.

Still, we must object strenuously when France, as declared by her Premier Edouard Daladier on June 15 last, thinks it fit to attack Japan in these words: "We consider inhuman bombings in Spain and China as an attack on civilization itself, which will ruin in a few seconds the heritage which has been left by centuries. Our duty is to struggle incessantly without respite in an effort to prevent such violence from becoming contagious." Apparently a declaration of high motive so far as the expression goes. And as such, no one will gainsay it.

France is no Angel

But what right has France to characterize Japan as inhuman and as an enemy of civilization, as if France herself were an angel and had done nothing inhuman and would never employ her air force, which she is rushing to build up and of whose destructive power she is very proud? In case she has to fight with her neighbors—let us say just for argument's sake—will she never dispatch her air armada to London, to Berlin, or to Rome to shower death and destruction upon them?

And did she not, according to former Premier Flandin, authorize secretly the carriage of war materials to Spain, as she is doing to China, to the amount of 25,000 tons even at the very time when she was taking part in London in the negotiations for the withdrawal of volunteers?

France herself must accept the charge of being an enemy of humanity and civilization, inasmuch as she is encouraging by supplies of arms the Red regimes of both Spain and China to prolong hostilities and increase the number of victims in order to enable herself to fish in troubled waters.

It is well for France, and in this matter, for other powers as well, before they call others names, to reflect on what they have actually done in the past, and what they are preparing for and will do in the future when they have to face the situation Japan is now grappling with. Eloquence cannot obliterate the past records. Words, however, embellished, sound hollow and carry no weight if they are insincere. Nor will time bury faults.

As a reminder to France, therefore, let us examine what she did in the days she first extended her grasping hands toward the Orient. The writer does not make mention of this particularly to blame or humiliate France. For what country has clean hands unstained by blood in its dealings with the peoples of other countries?

Gunboat Diplomacy

Sir Harry Parkes, the pioneer of the British gunboat-diplomacy in the East, in a letter to his wife dated June 12, 1861, wrote:

"One source of apprehension—viz., that the French when once they had an army in China would not readily withdraw—promises to be removed (from Canton). They have already had to call off nearly all their troops to reinforce their expedition in Cochin-China, and yet they have not sufficient force there to subdue to Cochin-Chinese, and are now resting on their arms there, waiting fresh orders from France."

This indicates that France was full of territorial designs on China and once she had an army in China she would not readily withdraw.

Parkes also wrote to his wife in London on July 25, 1860:

"This dreadful alliance (the Anglo-French Alliance) is a very very great reason for our devoutly desiring a speedy settlement of the question (the march to Peking). They do us no good and act in fact in every way just like a drag upon our coach. They use our stores, get in our way at all points, and retard all our movements. There is not a man in the army or in the embassy who does not wish the French away, and as the campaign goes on, England has every reason to regret the renewal of the alliance which has been the bane of the Crimea."

Previous to their march to Peking, British and French troops reduced the town of Pehtang not far from the mouth of the Peiho, and Parkes describes the disorderly manner of the French:

"The town, I am sorry to say, is in a bad condition, for it has been thoroughly pillaged by our troops. When I say 'ours,' I mean the whole force, for I must say that though our men misbehaved, their excesses have been far surpassed by the French for the reason that the latter make no attempt to prevent license of any kind, while our provost marshal does not spare the whip in the case of our people. The coolies of the military train are again far worse than either French troops or our own and have been going about breaking into houses, ill-using women, and plundering the people of everything. The affair has been mismanaged and really, so long as we have to work with the French, it is almost hopless to look for good management.

"It is useless for us to tell the people that we will protect them (as 'we' did tell them by proclamation when we entered town, for we don't, and with the French in company I don't think we can. . . . Pehtang just now presents a wretched spectacle. The people have all left it, and I regret to say that a good number, I daresay as many as 40 or 50 people, for the most part women, have made away with themselves, by poison or suffocation. If we are to leave such terrible traces of our course as this, we shall do ourselves a great deal of harm."

Then Parkes goes on in his letter:

"The saddest instance that came to my knowledge is that of one of the men who took me (to a Chinese camp) on the night of the first (August 1, 1860). His house was entered on the third no less than eight times by coolies. Three times he used my name, and they left without injuring him; but after that they had become excited by other pillage and by wine, and they completely ransacked his house. He received four visits also from French soldiers. The coolies threatened violence, and reduced him and his household to such a state of fright and terror that he and his wife and daughter and four women living in the same quadrangle all took poison. They were found dying and three were taken to the hospital, but the man alone recovered. All the six women died.

"Usher told me that in one day he had flogged 39 men who had been caught looting. The French, I believe, have not inflicted a single punishment. They seem to think that pillage is a soldier's right. They have even crossed the river and gutted a large village on the opposite side. At night, they steal out, cross into our quarter of the town, and have brought that half of the place into as bad a condition as their own. . . . From the French we experience only difficulty and delay; so General Grant told them yesterday that, however, he might regret their being unprepared, he must move on his men . . . . the French are ill-found in the first place, and their means of transport are very defective. . . . We lead and the French follow—they were obliged to come into our arrangements and follow our lead, because we said it could not be otherwise. Indeed, Lord Elgin, who is beginning to deplore the alliance, would have authorized General Grant to have gone on alone if the French had declined to move."

On October 13, 1860, the British and French troops compelled the Chinese at bayonet-point to assent to surrender unconditionally, and they made their triumphant entry through the lofty gates of Peking. Thus they passed from a state of war to a state of peace. A convention was signed, and ratifications of the Treaty of 1858, the chief object of the allied' army's march to the capital, were exchanged. English and French soldiers could now safely walk about Peking in small parties of threes and fours. Still, the victors were unsatisfied until exemplary punishment was inflicted.

Summer Palace is Razed

By way of taking revenge for their men who were killed when taken prisoners, they chose to raze to the ground all the palaces of Yuen Ming Yuen, the Emperor's Summer Palace, which had already been plundered by the allied troops. The French did most of the looting and destroyed everything of value in the palace, setting fire to the Emperor's private apartments. Most of the relics of the Imperial treasures which found their way to England are said to have been bought from French soldiers.

Thus the long standing struggle between China on one side and Britain and France on the other, which lasted for 20 long years, was now ended. During this period Canton, Nanking and Peking had been the favorite targets of British and French guns, which far outmatched in number and efficiency those possessed by China, only because they wanted to have their own way, considering it their right to open by force self-satisfied China's doors in order to satisfy their commercial as well as territorial greed.

The above is part of the description of how France came, together with Britain, to interest herself in the affairs of the Orient. Her first deed in East Asia was rather a sordid one and she had better think twice before she dares to criticize Japan's action in China. Let her remember that her compatriots were guilty of such acts of violence as quoted above and that her people are now benefiting from what they procured for them—concessions in Chinese ports and cities, commercial and industrial interest, not to speak of the colony of French Indo-China.

Bombing fortified cities such as Canton, Nanking and Hankow is definitely an action justifiable in the game of war. The killing and wounding of civilians in a war-zone by a few stray bombs is technically unavoidable in the exigencies of modern warfare. Did Premier Daladier believe even for a moment that Japanese military aviators bombed civilian populations deliberately? If so, he ought to study more closely the code of Bushido, Japan's Knightly Way.

In the light of the past records of Far Eastern affairs, is it too much to say that the example set by France became "contagious" and that other European powers undertook to have their share of territory of China?

Remember Liaotung Retrocession

We feel also a little uneasy lest the action taken by France immediately after the Sino-Japanese War in 1894-5 become "contagious"; I mean to say that some interested parties may dare to intervene in the present conflict between Japan and China. France was one of the responsible parties who dislodged Japan from the Liaotung peninsula which, by the treaty of Shimonoseki, she got from China as a prize of victory. If France had not joined the party of that intervention, Japan might not have had to wage war with Russia in 1904-5. She might not even have been obliged to establish the Empire of Manchoukuo, or might have been spared the present hostilities with China.

However, let us forget all these past grievances that we rightly have, only asking France to leave us alone and not to interfere in our affairs by giving aid to our enemy.

It is a great pity that France should listen too often and too credulously to China's false broadcast and that she chooses to dance to the tune of Chiang Kai-shek's hired propagandists. We quite understand why France thinks it best to stick to the theory of collective security as propounded by the League of Nations. We know all that; but as it is, Japan is the only stabilizing power of East Asia and it is hoped that France will realize this fact and co-operate with us to bring about peace in this part of the world. Japan's patience *vis-à-vis* the Chiang regime has long been taxed and she means to overthrow him and his confederates. So long as Japan does not accomplish this, there will be no peace for the people of Japan; nor will the masses of Chinese people be able to enjoy their lives in peace. The entire nation of Japan has now stood as one man and is determined to face and tackle the problems of East Asia—to bring order out of chaos.

Why does France meddle in the Orient—in the affairs of Japan? Japan resents what France is doing!

Trial Trip of the M.S. *Aconcagua*

On Saturday, April 9, 1938, the trial trip of the motorship *Aconcagua*, No. 83, of the Nakskov Shipyard Ltd., Nakskov, Denmark, for Compania Sud Americana de Vapores of Valparaiso, took place. The ship has the following principal dimensions:

Length between perpendiculars	410-ft. 0-in.
Breadth moulded	58-ft. 0-in.
Depth to shelter deck	33-ft. 9-in.
Carrying capacity	.. about 5,800 tons D.W.

The ship is built to Lloyd's highest class and in accordance with the rules of the international Convention for the safety of life at sea, and it is arranged as a cargo and passenger ship with accommodation for 34 passengers in first class, comfortably arranged with one- and two-berth cabins with adjoining bath—and toilet-rooms, in a large house on the promenade deck. Forward in this house a large dining-saloon and a ladies' saloon with furniture of polished mahogany as well as a smoking-saloon and bar-room with wainscots and furniture of polished nut-wood are situated.

For third class large four-berth cabins for 126 passengers, bath-rooms and toilet-rooms are arranged in a house on the shelter deck. The equipment is as for first class, only a little more simple. A large comfortable dining-saloon is provided for third class.

The ship has five hatches, two masts and two derricks, one of which has a lifting capacity of 35 tons and one for eight tons, which are served by two seven ton and one five ton electric cargo winches. The cargo winches, the electric windlass, a seven ton warping winch and the electric steering gear have been supplied by Mr. Thomas B. Thrige of Odense, Denmark. Further the ship is furnished with ten three ton electric cargo cranes of "Demag" manufacture. Habitation for the deck officers and the captain is situated on the boat deck and the navigating bridge. In the house on the shelter deck accommodation for the engine room officers and the restaurant staff is arranged. In forecastle and poop the crew is accommodated. The 'tweendeck aft is equipped for cattle transport with room for 190 heads of cattle.

The ship has five refrigerated cargo holds totalling 120,500 cubic feet, two of which are rooms for transport of frozen meat. The refrigerating plant has been supplied by Messrs. Thomas Ths. Sabroe & Co. of Aarhus, Denmark. The propelling machinery consists of one Burmeister & Wain double-acting, two-stroke-cycle Diesel motor of 7,400 i.h.p., which gives the fully loaded ship a speed of 16 knots at sea.

Stabilized Asia and American Cotton*

It would be a daring mind which would attempt to forecast the larger scheme of things to come from what is going on in what we Westerners call the Far East. A new pattern of dominance is being drafted for the continent, a new arrangement and marshaling of peoples and of nations.

The East is coming, for the second time in 2,600 years to full stature in relation to other cultural and governmental zones and groupings. And, frankly, if we say "America for Americans," and our cousins in Europe say "Europe for Europeans," why may not the men of Asia say, finally, "Asia for Asiatics."

I do not think that implies a policy of "scuttle" for either Europeans or Americans, but simply a wise recognition of new conditions in a changing world. I do not think it means, if recognized, a lessening of commerce, a loss of wealth to Europeans or Americans in the long run—perhaps the reverse.

Readjustments—tremendous ones, of course for Britain—but over the years a more wholesome and a stabler state of things.

It is a state of things which, if approached with minds which are reasonable and understanding, might be achieved in peace and with high benefit to every great natural group of humanity and interest. A state of things achievable—if approached with such minds—in orderly fashion over a term of years and with a due regard for the gradual liquidation, without injury, of special rights, privileges, and establishment.

Situation is Reviewed

Let me summarize the present situation :—

(1) Japan has practically consolidated her successive victories in North China and has established effective peace and order behind her lines in that section.

(2) Nanking, the capital of the Chiang Kai-shek regime, has fallen.

(3) Barring only possible interposition from Russia, the rest of the world, if not the Chiang government, will have seen the futility of further Chinese resistance.

(4) Japan will not make the high policy mistake of agreeing to what, from her viewpoint, would be premature peace, but will insist upon something that assures her a stable peace on the mainland ; the end of anti-Japanism in China ; full opportunity for developing the great market and rich stores of raw materials—coal, iron, and cotton—especially in North China, which means an outlet for her industries and opportunity for her thrifty, energetic population which increases at 1,000,000 a year within Japan proper and 1,500,000 in the Empire as a whole.

(5) Among the 70-odd million North Chinese themselves, impressed by the weakness of the Chiang government, a movement will be promoted for effective separation from South China ; perhaps a government of their own under Japanese protection ; perhaps practical consolidation with Manchoukuo by the restoration of the Manchu dynasty in Peking.

North China, after 25 years of turmoil and persisting civil war, can look beyond the Great Wall to Manchoukuo where, within five years, peace, order, and progress have been established firmly under a government apparently fitted to the traditions and customs of the people.

Hundreds of thousands of Chinese have been going voluntarily from North China to Manchoukuo every year—for safety and to work and profit.

(6) If Japan has not been justified in her various actions in Manchoukuo and North China in the last eight years, and this year in China as a whole, then the United States was not justified in the Mexican War, the Spanish-American War, and the establishment of the Panamanian Republic.

(7) If the United States, and especially the American Cotton South, is the loser and not the gainer in the Far East by reason of a firm Asian peace established by Japan—it will be the fault of American policy more than the fault of Japan.

Rise of Japan

Colonel Edmonds then briefly reviews the rise of Japan as a world power since 1854, pointing out that increase of population made some solution necessary. This solution was envisaged in industrialization, particularly in textiles. She repealed her tariff on raw cotton, began to import, and went after the Chinese market, which until then had been a British preserve.

He recalls the advent of Japan in the cotton markets of the South, which resulted in sales of hundreds of millions of bales of cotton to Japan and the consequent rise of prosperity for Southerners. The key to the situation lies with Japan, Colonel Edmonds continues. In brief, during recent years, Japan has bought American cotton, made it into cloth and sold it in China, largely. The past year this China market has failed, due to hostilities. The American cotton states have a huge volume of cotton on hand, on which the American government is advancing loans.

Japan wants American cotton, Colonel Edmonds says. If she is cut off from the American supply, she will seek to develop a supply in China. Failing that, she will look to other countries, where there is a supply and where she would be a welcomed buyer.

Hard Blow to America

If that situation came about, the writer says, then Japanese mills will be closed for all time to 800,000 bales of cotton grown in our South, affecting 100,000 families directly and 2,000,000 indirectly. But, with developments in China under a stable government, it is pointed out that there is every reason to believe the demand for U.S. cotton would expand until the market would take 1,500,000, or even 2,000,000 bales.

America now has a stock of 20,000,000 bales of cotton. The world price is low, and there is enough cotton in the world to keep all the world's mills running without buying any in this country. If the Japanese do not buy American cotton, the writer asserts, it will stack up in warehouses under government loans at around $45 a bale. Thus, instead of moving into world markets it will be a drug at home, with hundreds of millions of government-borrowed money tied up in it, and no immediate prospect of liquidating those huge loans.

Possible Market Seen

The population of China is estimated at around 400,000,000 people. The possibility is visioned of this mass of humanity being freed from the strife and turmoil that has prevailed in the past and being able to go to work, to earn, buy, and develop the land's resources and attain a higher standard of living.

Basic food for the masses must be produced. There is sufficient manpower there for that, but with settled conditions there would be a great development in demand for labor in industrial works, mines, railroads, and other enterprises. Thus the millions of workers would not only have to have food, but would have purchasing power to buy goods which go with a higher standard of living.

Japan buys from the United States normally between $3 and $5 per person per year of commodities. China buys between 25 and 30 cents' worth. The average Japanese in these days is 10 times a better customer than the Chinese. Although China produces most of her food normally, with increasing prosperity she would buy foodstuffs also from the United States to vary the diet.

"Only unless needs must," the colonel says, "would Japan's leadership shift Chinese masses extensively from producing foodstuffs to producing cotton. Chinese hands and acres would be more advantageously employed in other occupations."

Reverting to statistics in dealing with the huge Chinese population, the writer shows that under peaceful conditions with only one new cotton dress for each woman, a couple of shirts for the men, a pair of bedsheets—to be had cheaply under Japanese manufacture—a market would be created for 2,000,000 bales of American cotton.

Vast Possibility is Seen

The potential market is so vast, as Colonel Edmonds sees it, that the entire United States would be affected, just as it is affected

(*Continued on page 281*)

*From an article in the New Orleans *Cotton Trade Journal*, by Col. James E. Edmonds, and condensed by the *Osaka Mainichi*.

Electrical Development in Malaya*

By H. R. SPARROW, M.I.E.E., Adviser on Electricity, Malay States

THE year 1937 has been the eleventh during which the Electrical Department of Malaya has been operating as an independent Government department and it is gratifying to report that sales of energy have reached record figures at every station. At three stations the demand for energy exceeded the available supply due to the limited capacities of the plants concerned. This rapid development in the generation and supply of electricity has been general throughout the country and affords a fair indication of the measure of prosperity enjoyed, and of the ready adoption of electricity as motive power for industrial and domestic uses.

In the four Federated States the total accounted units generated during the year under review by Government and companies was 520,970,014. The 1936 and 1935 figures were 446,794,999 and 297,969,927 units respectively. The 1937 units therefore show an increase of 16.6 per cent over 1936, and the 1936 units an increase of 95.8 per cent as compared with 1935.

It is to be regretted that, owing to the limited capacity of the Government generating plants in Selangor, many applications from local tin mining and other industrial concerns had to be refused, and the deficiency made good by the adoption by those concerns of oil engines for motive power. Adequate measures, however, are being taken to meet future supply demands. The Bungsar Power Station, Kuala Lumpur, is to have its generating plant capacity increased by 12,500 kilowatts. The Klang station capacity was increased by 500 kilowatts during the last quarter of the year, although in this case, the new generating set installed was at the end of the year still under test conditions.

The scheme of major extensions to the Bungsar Power Station was finally approved in March, and indents for the necessary plant were dispatched to England without delay. The necessary preliminary work in connection with this scheme has progressed steadily.

With special reference to the extensive water cooling system required, the department has taken advantage of the advice and executive assistance of the Drainage and Irrigation Department. Difficulties in connection with the best utilization of the existing system of cooling water flumes were, after examination, soon apparent.

At a later stage, the Public Works Department were asked to co-operate on the scheme for the extension to the existing station building and foundation.

The present capacity of the Bungsar Power Station is 19,000 kilowatts. Orders have been sent to the Crown Agents for the Colonies for a new 12,500 kilowatts generating set and two additional boilers each rated to produce 75,000 lb. of steam per hour. To house these units the station building will have to be extended by sixty-six feet in length.

Overhaul Cooling System

The existing plant water cooling system will be thoroughly overhauled and supplemented to deal with an additional 18,000 gallons of water per minute. Certain ingenious and original devices to ensure continuity of water supply even under severe abnormal conditions have been incorporated in the plans prepared by the Drainage and Irrigation Department. An additional travelling gantry crane will be installed for handling coal and ash. It is hoped that the scheme will be completed and the new generating set put into commission during 1939.

The fact cannot be ignored that there are great industrial possibilities in the Klang and Port Swettenham areas. During the last two years progress has been such that power demand has exceeded the supply. These areas offer favorable inducements for industrial development such as close proximity to available raw materials, excellent rail and road communications, favorable location on the national highway for shipping and available factory sites at low values. It therefore remains to provide an adequate supply of energy.

Coronation Memorial Clock, Market Square, Kuala Lumpur

To ensure an adequate supply of energy for the future, work was commenced during the year on the erection of a new duplicate 66 kilovolts transmission line between Kuala Lumpur and Klang to supply these areas, so that when the new extensions to Bungsar Power Station are completed the present plant at Klang will be moved and utilized elsewhere. Other extensions and proposed extensions in the four Federated States are as follows:

(i) PERAK.—Work was well in hand at the close of the year on the new generating station at Tanjong Malim, consisting of one 50 and two 25 kilowatts alternators coupled to high speed oil engines. The old plant consisting of two 22 kilowatts and one 15 kilowatts direct current generators will be scrapped, and the supply rendered suitable for alternating current.

(ii) SELANGOR.—A new scheme for electrifying Kuala Kubu Bharu was approved and work on the new power station and supply mains will commence during 1938.

(iii) NEGRI SEMBILAN.—The electrification of the townships of Kuala Pilah and Tampin, under a concession agreement with the Government, was in progress during the year. The construction of the two power station buildings was started during December. The wiring of Government quarters and buildings, under departmental supervision, was completed. An additional 25 kilowatts generating set was ordered for Port Dickson and the installation of this oil-driven set was nearing completion at the close of the year. A 24-hour supply will be inaugurated early in 1938.

(iv) PAHANG.—Schemes for new supplies to Mentakab, Temerloh and Fraser's Hill were approved and work will commence during 1938. The plant capacity of the Kuala Lipis station was increased by the installation of a new 90 kilowatts oil-driven generating set. The erection of a new 25 kilowatts oil-driven generating set at Kuantan was commenced and the work should be completed early in the new year.

Coronation Illuminations

The illuminations during the celebrations held in honor of the Coronation of Their Majesties the King and Queen during May

* From the Electrical Department's Annual Report

caused peak loads at all stations to rise from 20 to 50 per cent above normal. Well organized schemes of illuminations in the various towns and villages produced pleasing effects, which with the general festive air prevailing at the time, made the occasion a memorable one. What is not generally known by the public who enjoyed the bright lights is that the majority of the floodlights and decorative lanterns, etc., used by this department were made locally.

A commemorative clock tower was erected at Market Square, Kuala Lumpur, and completed in time for Coronation Day. Beneath the clock tower is an underground sub-station of 300 kva capacity and the tower itself hides the steelwork structure necessary for lifting transformers and other equipment in and out of the sub-station. The edifice is constructed of reinforced concrete and finished with a granolithic polished surface in blue black and light grey. Heavy bronze plaques are attached to each of the four sides bearing an inscription commemorating the Coronation of His Majesty King George VI.

Transmission—Overhead and Underground

The Kuala Lumpur system has 342 miles of overhead and 69 miles of underground mains. All key switching points on the extra high tension system are now controlled by switchmen under the direction of the Mains Engineer. Quarters equipped with telephones have been built in close proximity to the switch towers with the result that outages through line faults are reduced to a minimum.

Parts of the overhead transmission system pass through wild jungle and certain switching points are located at fair distances from civilization. The switchmen, therefore, are not over anxious to occupy quarters at these isolated points. Monthly reports received from these lonely employees sometimes conclude with a request for a gun to protect them from prowling panthers, tigers and other beasts of the jungle.

Alarm was caused one night when a certain switchman reported that a herd of elephants had solemnly walked in procession past his house and was following the path under the line. Fortunately the elephants were on their best behavior that night and damage was confined to pushing a number of poles a few inches only out of the true vertical.

Even though overhead mains are liable to damage from beasts of the jungle, one would have thought that mains laid snugly underground in the streets of local towns would be untroubled by any living creatures, with the exception of man. More destructive to supply mains than any wild elephants, however, are the white ants, which destroy not only wooden poles, etc., but even attack steel armored underground cables. Two steel armored 11,000-volts underground cables laid in Kuala Lumpur have suffered damage in this manner on several occasions during the last few years. Examination of the faulty sections showed that white ants had penetrated the steel armoring and cut right through to the cores. A faulty joint box, also, was found to be full of these termites. The wise engineer in Malaya, therefore, when ordering new underground cables, specifies additional brass sheathing, since experience has shown that the termites do not attack this metal.

Street Lighting

Experiments in street lighting by means of vapor discharge lamps were carried out during the year in Kuala Lumpur and Ipoh and as a result orders for two popular types of these lamps have been sent to the Crown Agents. When the new lighting system becomes operative in these towns during 1938, there should be a marked improvement as compared with the present lighting.

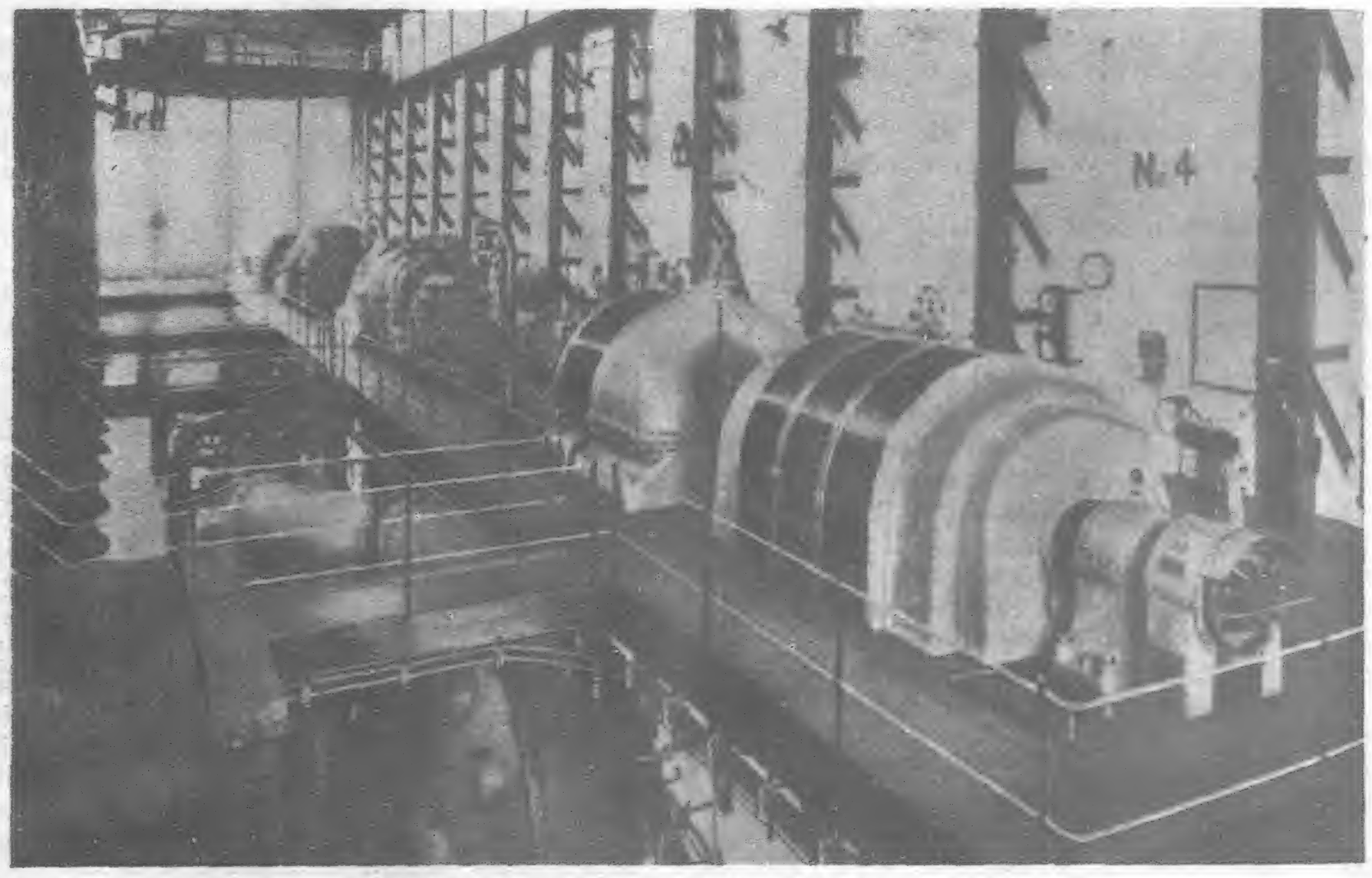
Reduction in lighting rates were made, during the year, as follows:

Place	*Rate*	*Percentage reduction*
Kuala Lumpur and District, Klang, Rawang	Domestic	10%
Raub, Bentong	Street Lighting	16.6%
Seremban, Gemas	Street Lighting	37.5%

The above reductions represent a sum of $70,000 and $30,000 per annum respectively based on existing demands.

The M.A.H.A. Show

Little had been done in the past in Kuala Lumpur in educating the public in the advantages to be obtained from better lighting and in the majority of homes the plain pendant was accepted as electric lighting in its only form and its glare and unsightliness taken as inevitable.



Interior of turbine room, Bungsar Power Station

With this in view a stand was taken at the Malayan Agri-Horticultural Association Show during the year and an exhibit designed around the solgan "Better Light—Better Sight." The stand itself was of modern appearance containing a tastefully decorated lounge, lighted by modern translucent glass pendants, wall brackets, floor and table lamps which were contrasted in turn with an ordinary pendant, by means of an automatic switching device.

In addition, two lighting models were shown, one depicting the evils of glare and the other in which the observer could select for himself the correct intensity of illumination for the reading of close print. All members of the community showed a considerable interest in the exhibit and from the many queries raised we decided to continue our efforts in the development of better lighting.

During the year the showroom at Gombak Lane was altered and modernized with the object of showing better lighting, and this work is not yet finally completed. The showroom was also fitted with a cookery demonstration kitchen and series of lectures and practical demonstrations were given by ladies interested in the Y.W.C.A. All phases of cooking, the preparation of salads and the making of ice cream and cold dishes were shown and an

appreciative audience were regularly attracted, as many as forty-one ladies having on one occasion attended. The recent unprecedented demand for electric cookers and water heaters is due in no small measure to these demonstrations and a further series are now being carried out.

The showroom is being developed with the object of advising and guiding consumers in their choice of lighting, wiring and domestic apparatus and every effort will be made to encourage its use by commercial firms, architects and private individuals. The showroom is looked upon as a shopwindow in which we display our products and it is planned in the future to give much more attention to this hitherto comparatively undeveloped field.

The Electricity Enactment

EXAMINATIONS.—In accordance with the requirements of the Electricity Enactment no person in the Federated Malay States except an authorized person or a competent person acting under the supervision of an authorized person is allowed to undertake any electrical work where technical knowledge or experience is required.

At the close of the year under review the total number of such authorized persons was 4,803, consisting of 327 " engineers " (Grades I, II and III), 3,789 " chargemen " (Grades I and II) and 687 " wiremen."

Each authorized person must hold a certificate of competency issued by the Board of Examiners and before a certificate is issued a candidate must satisfy the examiners that he possesses the necessary experience and qualifications.

Owing, however, to the rapid development in the generation and supply of electricity in this country, there is an ever greater demand for such " authorized " persons, with the result that, at the close of the year, applications to sit the examinations were so numerous that members of the Board of Examiners were unable to cope adequately with the work.

ACCIDENTS.—Electricity is a good servant but it must be treated with respect. Installations must comply with the safety requirements of the Enactment and it is the duty of the Inspection Branch to see that these requirements are fulfilled. Accidents, however, are liable to occur and it is to be regretted that during the year under review six persons in the Federated Malay States were electrocuted.

33,000 volts transmission line construction, Serdang loop line

No. 1.—A laborer, while feeling his way through a garden before dawn one morning, came into accidental contact with a wire clothes line strung across his path. The clothes line was suspended between a wooden beam, supporting part of near by quarters, and a tree. The beam carried insulated current carrying lighting conductors at 230 volts. Friction over a period of time, between the clothes line and the conductors had worn through the insulation and the clothes line became alive at 230 volts. The unfortunate man had grasped the clothes line in his hand and was unable to release his hold. When discovered *rigor mortis* had already set in.

No. 2.—A motor attendant was severely burned as a result of falling upon the open connections of a live transformer at a mine. He died in hospital eleven days after admission.

No. 3.—A small child was killed at a local cinema through coming in contact with a 230 volts broken lighting wire.

No. 4.—An uncertified workman was instantly killed when he interfered in the repair of a broken lighting wire at an open cast mine during a thunderstorm.

No. 5.—A laborer was killed outright by coming in contact with a broken and hanging wire which, in turn, was in contact with an extra high tension overhead line. The E.H.T. line had been damaged during a recent thunderstorm.

No. 6.—An elderly cook employed in the communal kitchen of quarters occupied by several mine workers, early one morning proceeded to fill his cooking vessels with water from a tap in the corner of the kitchen. On turning on the water tap he received a severe electric shock and was unable to free his hand. His cries brought other occupants of the quarters to his aid and they had much difficulty in releasing his hold on the tap. The victim became unconscious and although artificial resuscitation was applied and oxygen administered the treatment proved ineffective and the victim succumbed.

An investigation revealed that the water main had become electrically " alive " from a faulty electric geyser installed at nearby neighboring quarters, between which the private water main was laid. The geyser had been " earthed " to this pipe but tests showed that the " earth " protection was inefficient and that the water main became " alive " at an effective voltage of 188 volts.

Departmental Stand M.A.H.A. Exhibition, 1937

Unfederated States

Advice was given to the Unfederated State of Kelantan on a proposed scheme for the conversion of the Kota Bharu supply from direct to alternating current and extensions to outlying districts.

At the request of the Trengganu Government a report was submitted on the possibilities of an electricity supply for Kuala Trengganu and Kemaman.

Underground Passage Proposed

The Hankyu Electric Co., has proposed to the municipal office the plan of an underground road between the Amusement Center and Umeda Station. The subway is from the basement of the Hankyu Department store to the Umeda underground restaurant. The length is to be 50 ken, width 2 : 2ken and height 8 shaku.

Bhavnagar, India's Newest Port*

By Lt.-Col. B. C. ALLIN, Director and Chief Engineer of the Port of Stockton, California, U.S.A., Consulting Engineer to the Bhavnagar State, India

THE Port of Bhavnagar, lying on the eastern shore of the Kathiawar Peninsula on the West side of the Gulf of Cambay, on the West Cost of India, presents a number of interesting, and even unique, features.

The Gulf of Cambay, which is little known outside of India, is the seat of the earliest commerce of Europe with this fascinating Empire. About A.D. 1500 the Portuguese made their first visit to India, and about ten years later established their capital at Goa on the West Coast of the peninsula. Slowly the Portuguese influence moved northward up the coast and eventually reached the peninsula of Kathiawar.

The English, meanwhile, became interested in trading with India, and finally in 1609, the first British ship *Hector* dropped anchor at the Port of Surat in the Gulf of Cambay—the first British vessel to anchor at an Indian port.

From this time henceforward for many years a very considerable trade ensured through the ports on the Gulf of Cambay, during which time Bombay, which was a group of seven islands located on the bay of that name, developed into a considerable harbor, due to its natural advantages.

Bhavnagar is first mentioned as a port in the early part of the 18th century, and has for more than 200 years been a port with an interesting history behind it.

From a political standpoint, the Port of Bhavnagar is one of considerable interest, in view of the fact that it is in one of the Native States and not in British India. Many years ago the State of Bhavnagar arranged a commercial treaty with the British Government whereby, for concessions granted, it was given the right to develop its port and collect its own customs revenues, which, however, according to the treaty, must be the same as are collected by the British ports.

As a consequence there is a considerable difference between Bombay and Bhavnagar, and the competition which exists, for example, among American ports, where the only incentive in port development is the collection of port dues and the general advancement of the community, while in this case in India there is the customs revenue, which for the year 1930 amounted to approximately $1\frac{2}{3}$ million dollars at Bhavnagar.

When goods are imported into India through Bombay, the British Indian Government gets the customs revenue irrespective of the point in India to which they are consigned, whereas when goods are imported into India through Bhavnagar, irrespective of the point in India they reach, the State of Bhavnagar gets the revenue.

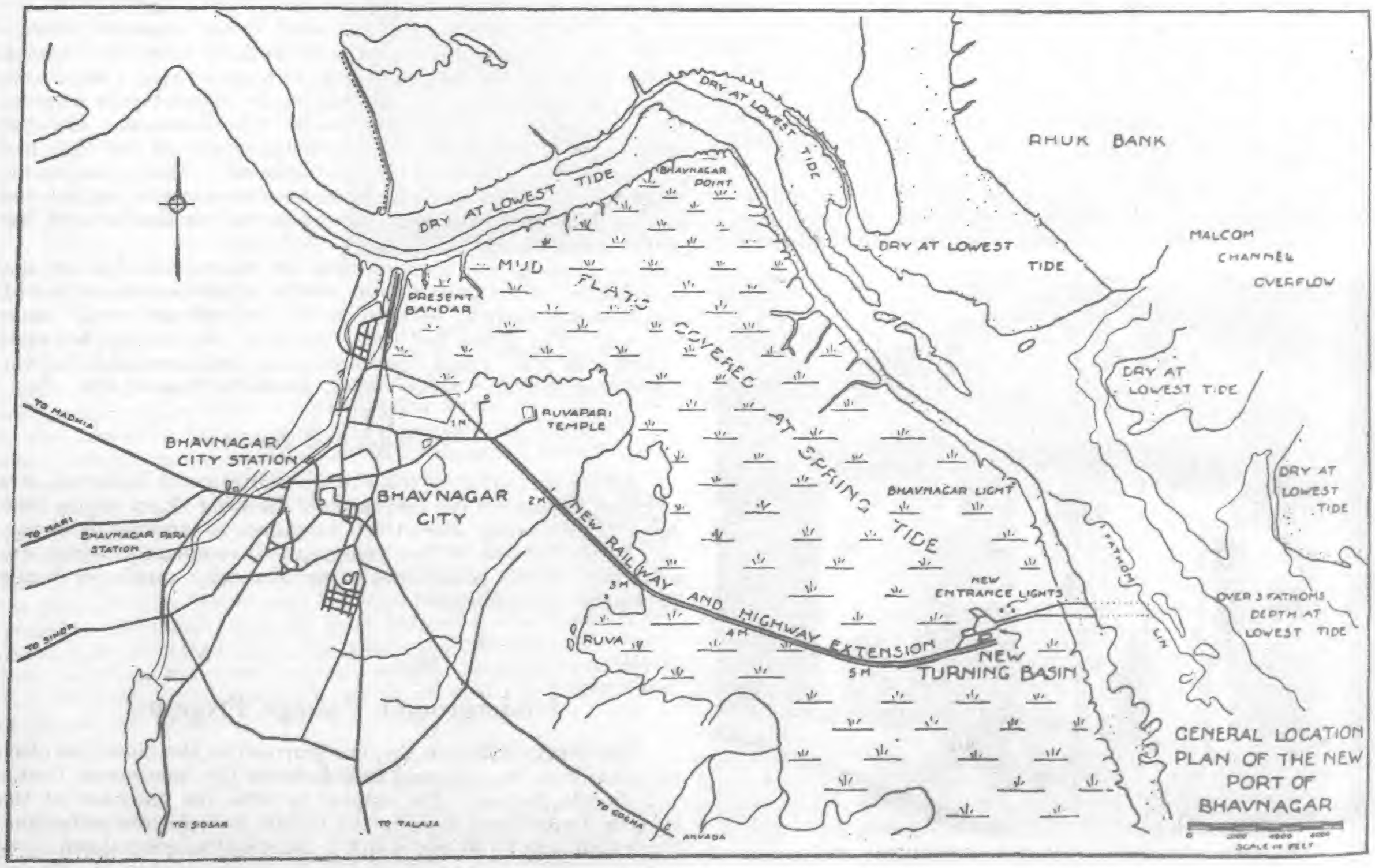
The railroads from Bhavnagar and Bombay serving the north central portion of India join immediately north of the head of the Gulf of Cambay, and Bhavnagar has an advantage in being 139 miles nearer to this junction than is Bombay, thus giving it a mileage handicap over Bombay in the serving of a tremendous interior section of the country.

Probably the largest factor in the delay of Bhavnagar in developing its port has been the peculiar condition in the Gulf of Cambay.

This Gulf has a length from north to south of approximately 100 miles. The width of the entrance is about the same, and on two-thirds of the way inland it has a width of from twelve to twenty miles, which width continues to the innermost limit.

A number of rivers tributary to the Gulf have caused very considerable silting, so that a large portion of the interior section

*Reproduced with revision from the *Bulletin of the Permanent International Association of Navigation Congress*, No. 23, January, 1937, by the Dock and Harbor Authority.



of the Gulf has already filled up to above sea level and large mud flats, miles in extent, are spread about the center of the estuary.

The most unusual condition present in the Gulf, however, is that of the tides. A tidal force which has its node in the vicinity of the Lacadive Islands reaches its maximum at Bhavnagar. This tide, which at the entrance of the Gulf reaches a height of probably 14-ft. at Bhavnagar, reaches a maximum of over 39-ft. on spring floods and a minimum height on neap floods for the year 1931 of about 23-ft.

The present Port of Bhavnagar is situated on a creek of the same name, approximately six miles above its entrance into a larger estuary, whence it is approximately six miles more to the main open Gulf.

Main jetty between road approaches 1 and 2, January 14, 1936

The creek, although silted up to above low tide in most sections has the appearance of a Mississippi on high tides and the extreme tidal action causes a current of from 5 to 6 knots. The drainage area of the creek brings into it a fine silt which with the tidal section is moved up and down the creek in suspension, the water containing at times as high as 11 per cent solid matter.

As a result of the deterioration of the creek the State of Bhavnagar has obtained reports from a number of European engineers during the past 25 years. Some of these people held the opinion that Bhavnagar should be abandoned entirely as a port, and others advised a dredging program in the river in spite of the handicap.

During this period, while the State has been hesitant as to the best course to pursue, the deterioration has been so great that vessels handling overseas cargo have stopped coming into the creek and have remained at anchorage in the entrance, the cargo being transported by lighters for a distance of from 8 to 12 miles to the docks.

This, accordingly, was the situation which confronted me when I was called in to advise and report in 1931, and it seemed most desirable that a solution to this difficult situation be obtained, making possible the continuity of service of Bhavnagar as a port, in view of the strategic position it holds and its advantages in this regard over other possible port locations in the State, and also due to the fact that it is the capital of the State and a commercial center of considerable importance.

Study was given to conditions in the Gulf of Cambay, a very convenient basis for this being the Royal Indian Marine Surveys of 1886 and 1926, furnishing a forty-year contrast.

The major tidal force swings into the Gulf of Cambay from the south-west, running along the shore of the Kathiawar Peninsula fairly close to the shore line and passing Bhavnagar approximately six miles from the entrance to the creek.

It was consequently plain that the water at this location would be safe from deterioration for centuries to come, and that the only critical point would be the six-mile stretch—and the creek. The country between the city and the shore line at the mouth of the creek—six to eight miles distant—is comprised of level mud flats, which are covered with from 2 to 4-ft. of water at very high spring tides.

The tidal current flowing out of Bhavnagar Creek sets away from the shore line diagonally, leaving a triangle of slack water between the major tidal force of the Gulf of Cambay and the shore line. Study developed that the depth of water in this triangle has not materially changed in 40 years.

Consequently, it seemed certain that if a port could be located in the tidal flat near the open water and abandoning completely the Creek which is deteriorating, the problem would be solved for a century or so.

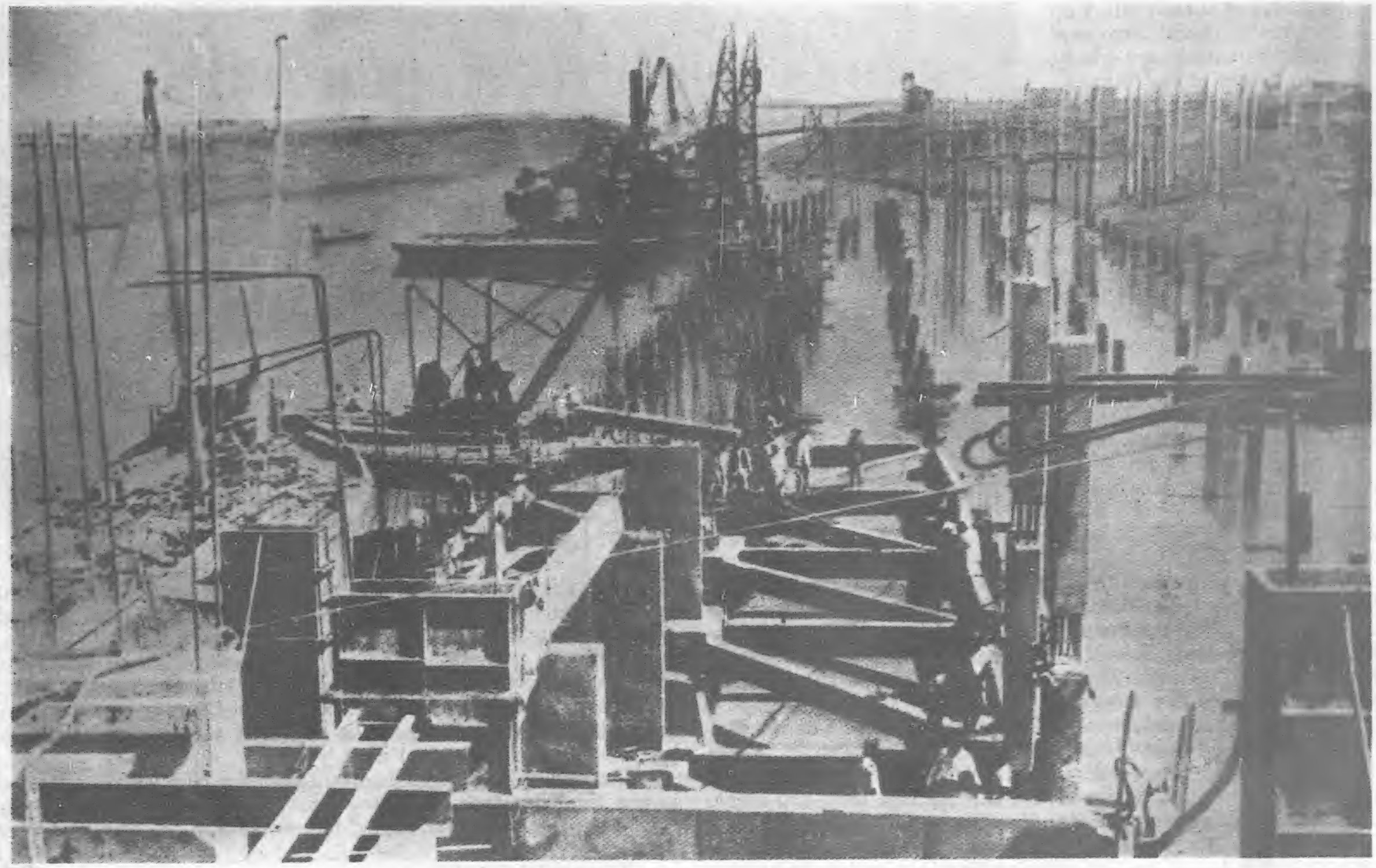
These tidal flats have an average elevation of 28-ft. above low tide, and due to the tidal range it was decided to construct the wharf and warehouses at an elevation of 42-ft. above low tide.

Boring operations were taken at a point about five miles from the city and one mile inside the actual shore line, to determine the nature of the soil, and the result showed a sandy silt which seemed well adapted to any reasonable dredging program. It was consequently decided to develop a port through the medium of a dredged channel, dredging it to 6-ft. below low tide, thus giving approximately 29-ft. of water through the channel at the lowest high tide in the year.

The entrance section of this channel in the open water required dredging for a short distance of approximately 3,400-ft. before the actual bluffs of the shore were reached. This section was laid out with a width of 500-ft., the dredging being a very shallow cut, running from nothing to a maximum of 10-ft. at the shore. The channel itself inside the shore line was laid out with a bottom width of 100-ft. and slopes of three on one, and at the interior end was laid out a turning basin to be used for the construction of wharves and facilities and for the turning of the vessels.

One side of this turning basin was designated as the initial wharf section, along which the first docks were to be constructed and this section was prescribed to be dredged to a

Map showing the location of the Port of Bhavnagar



Looking east from No. 2 road approach, February 8, 1936

depth of 28-ft. below lowest tide on a 100-ft. width, in order that vessels while lying at the wharf might at all times remain afloat, although they would enter and leave the port only at high tide.

The material obtained from the dredging provided fill for the reclamation of the port area around the turning basin, a fill of an average of 12-ft. being required for this. Extending along both sides of the channel and at a distance of several hundred feet from it were provided protection levees to be pumped up without retaining levees with a minimum top width of 200-ft. at an elevation of 6-ft. above the highest high tide.

It was naturally concluded that there would be a certain amount of silting in the turning basin, especially in the deep section, and also at the channel outer entrance, but in view of the fact that the channel entrance was in slack water which had not shown a tendency to fill in 40 years, and also in view of the fact that the tidal prism in the artificial channel and the turning basin was extremely small, it was well expected that this would not prove burdensome, certainly not as contrasted with what the State had been experiencing.

An interesting feature was prescribed with reference to the method of dredging. Due to the tidal fluctuation, it was desirable to devise a method whereby the capital program could be prosecuted without the dredging plant remaining stranded at low tide, and consequently it was provided that the dredge would commence work at the shore line, and at high tide, and would dredge an initial narrow entrance cut into the bank not lower than 13-ft. above minimum low tide. Proceeding with this inland for a distance of some 500-ft., the dredge would then proceed to cut the channel with full width and depth, leaving the 500-ft. section as a natural dam which would always during the progress of the inside work assure a depth of 19-ft. of water in which the dredger would work, while at the same time, fuel barges and other auxiliary craft could enter the channel at high tide.

The very unusual silting effect which pertains in this locality could be determined in its effect on the project only by very careful study with a proper hydraulic model, but these facilities not being immediately available, certain phases of the work were to a certain extent experimental, among which was the question of the sill.

Mr. Moorehead, who was appointed Manager and Advisor of the Bhavnagar State Ports and carried out the work under my direction, found that with the sill at the height originally contemplated the silt content, which is normally 0.85, became much greater, and consequently interfered with the condensers of the dredges, and he found it desirable to lower the sill during the process of construction. This, with beneficial results, was accordingly done, the still being lowered to a point where flotation of the dredging plant would have been reduced.

It may reasonably be expected that a wharf to serve a wet dock having a 39-ft. range of tide would be somewhat unique, and as a matter of fact, the wharf rises 70-ft. from the mud line to the deck. The initial structure has been prescribed with a length of 600-ft. minimum with provisions for further extensions in the future, and is to be designed for a live load of 300 lb. to the sq. ft. in addition to railway and crane loads.

The actual length of the wharf as determined by Mr. Moorehead is 882-ft.

The existing wharf at Bhavnagar is of steel construction and resting on screw piles, being designed for a live load of 200 lb. In the present case, screw piles were not recommended, inasmuch as the full weight of the structure rests upon the screws, whereas with friction piles the weight is taken up by the entire section of the pile which penetrates the ground, and the added height and loading desired were not considered desirable for screw piles. Accordingly, an open concrete pile structure was recommended.

The initial shed construction consists of galvanized iron buildings, 80,000 sq. ft. in area, located in the rear of the wharf and designed for transit cargo only, the existing group of warehouses at the old port continuing to be used for the storage of goods in bond. Three approaches will connect the wharf with the shed, and tractors and trailers are prescribed for the handling of cargo between the shed and the jetty, the three approaches making transportation over these possible in continuous loops either when one or two ships are working simultaneously and thus avoiding congestion.

(Continued on page 281)

Mineral Deposits of the U.S.S.R.

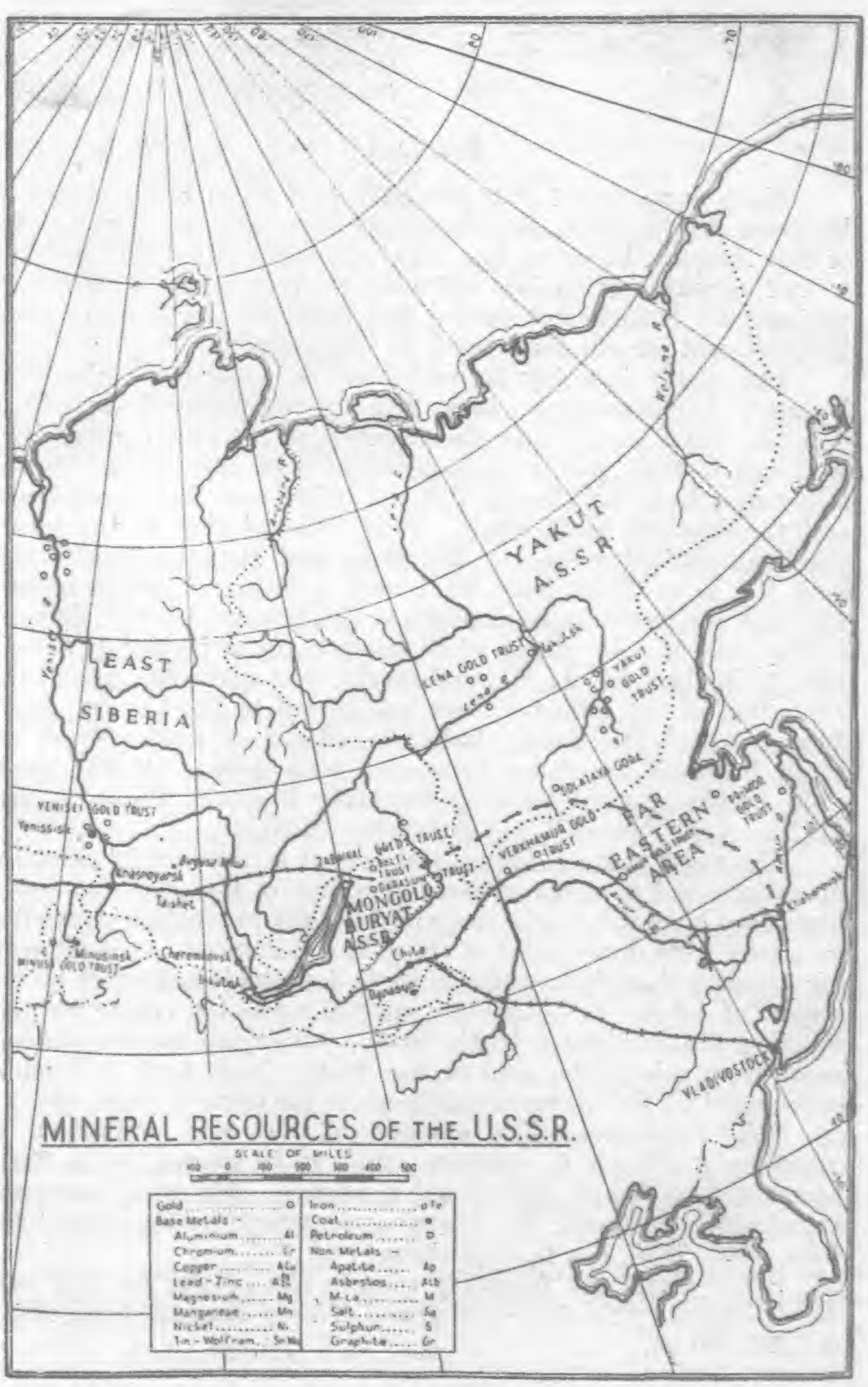
By TOM EDWARDS, A.R.S.M., B.SC., in the Mining Magazine

The author presents information regarding certain Russian mineral deposits obtained as a member of the XVIIth International Geological Congress.—Editor.

* * *

IT is the intention of the present article to assemble information concerning certain of the mineral resources of the U.S.S.R., obtained during a short stay in the country as a member of the XVIIth International Geological Conference, as well as from the publications mentioned later. The Congress, which took place in July and August, 1937, performed a double function in that it enabled geologists and mining engineers from all parts of the world to come together to discuss certain problems, among them the Petroleum Problem and the Petroleum Resources of the World; Correlation of Tectonic Processes, Magmatic Formations, and Ore Deposits; Geophysical Methods in Geology, and Geology of the Arctic Regions. In addition, it gave them the opportunity of seeing many of the areas of geological and mining interest in the U.S.S.R. Among the excursions arranged with this object in view—excursions taking place both before and after the congress—were included tours to the Ural Mountains; the Ukraine, Donetz coal basin, and the Crimea; the region of the Caucasus; to Novaya Zemlya and the Arctic Regions; to Karelia and the Kola Peninsula, as well as a petroleum excursion to the Georgian S.S.R., the Azerbaijan A.S.S.R., the Bashkirian A.S.S.R., etc., and a Trans-Siberian excursion, the intention of which was to take members practically the whole of the distance across Russia eastwards, on the Trans-Siberian railway. Each excursion was in charge of one or more Russian geologists, who, with the aid of interpreters, guided the party from day to day and summarized the features of importance from a geological, mining, and mineral resource point of view. Information on most topics, with the special exception of gold, was freely given and visits to mines, under the charge of the mine officials, were quite frequent.

The actual session of the congress was held in Moscow and all the major meetings were held in the Conservatoire of Music, which had been specially fitted up for a gathering of such a cosmopolitan character; delegates were present from most European countries with the exception of Germany and Italy; from the United States, South Africa, China and Japan, Canada, Uganda and Tanganyika, etc. Normally, each speaker spoke in his own language, although there was a noticeable tendency to use English as a *lingua franca*. However, everyone was enabled to understand the substance of the speech or paper by listening, with a pair of headphones attached to the back of each seat, to a simultaneous translation in all the official languages—English, German, French, Spanish, and Russian—by interpreters concealed at the front of the hall, each separate translation being obtainable by using a different plug for the phones. The sectional meetings were held



variously, in the Academy of Science, in the Institute of Economic Geology, and in the hall above. An enormous amount of trouble had been taken by the Soviet geologists to prepare, in the Conservatoire, a comprehensive exhibition of the mineral wealth of the Union, comprising mineral specimens from most important regions, together with sections, plans, and summarized descriptions of the occurrences. This exhibition was the major one, but each excursion had opportunities of visiting many special and local exhibitions dealing with the particular deposits of the area. One could not help being impressed by the amount as well as the intensity of the work being done by the Soviet geologists toward the discovery and development of new mineral resources.

Gold Production Increases

The present article is divided into sections dealing with gold, base metals, iron, coal, petroleum, and, finally, the non-metallic minerals, the sections being taken in the following order :—

I.—Gold
II.—Base Metals
- (1) Aluminium
- (2) Chromium
- (3) Copper
- (4) Lead and Zinc
- (5) Magnesium
- (6) Manganese
- (7) Nickel
- (8) Tin and Tungsten

III.—Iron
IV.—Coal
V.—Petroleum
VI.—Non-Metallic Minerals
- (1) Apatite
- (2) Asbestos
- (3) Graphite
- (4) Mica
- (5) Salt
- (6) Sulphur

I.—Gold

There is no doubt that the gold production of the U.S.S.R. has been steadily increasing during the last few years ; the amount of this increase, however, has been very differently estimated and a brief summary of various estimates is given later. This will be prefaced by remarks concerning the structure of the gold-mining industry and certain features of its operation.

The whole industry is controlled by Glavzoloto, the Gold Industry Administration ; under this are subsidiary Trusts, 26 in number, which group under their control all the mines and alluvial workings in their particular local area. The chief trusts are the following : Lena Gold Trust, Yakutsk Gold Trust, Balei Gold Trust, and the Darasun Gold Trust. It is believed that in the future the Trans-Baikal area—i.e., the Balei and Darasun Trusts—will oust the Lena Trust from its former position of predominance, although the newly found deposits in the Kazakh A.S.S.R. promise a large output. In charge of Glavzoloto are at present I. Oparin and A. Borisov for A. P. Serebrovski, who controlled the initial expansion of the industry, was transferred to the Copper, Lead, Zinc group of the Heavy Industries Board of 1936. There are three Research Institutes concerned with gold : (1) The State Gold Institute, (2) The Gold Scientific Research Institute, and (3) The Gold Research and Surveying Institute.

The major portion of the gold output is obtained by dredging operations and it seems unlikely that any of the gold won comes from deep-level mines, the magnitude of the production depending on a very wide distribution of the gold occurrences. It is interesting to notice that the working of these deposits is facilitated by the system of Artels—i.e., collective units of up to 100 people who are supplied with machinery by the State—who share out the eventual profit from sale of the gold to the State. This form of work is encouraged by Government privileges in the form of loans, etc.

Gold Production.—The amount of the gold production is exceedingly difficult to estimate, since it is treated as a State Secret and no definite figures are published. However, using the authorities mentioned, the following summary for the years 1933, 1934, 1935, 1936, has been produced :—

1933.—From the following sources the output for this year was estimated by the *Engineering and Mining Journal* (June, 1935), at 2,667,100 oz.

Interview of Stalin with W. Duranty, December 25, 1933.
Statement by A. P. Serebrovski.
Economic Cabinet of Professor S. N. Prokopovich, of Prague.
Sovetskaya Zolotopromyshlennost (The Soviet Gold-Mining Industry).
Izvestiya ; Za Industrializatsiya ; The Bolshevik.

1934.—From the same sources the estimate for 1934 was 4,262,572 oz. From an estimate by H. N. Lawrie (author of the gold and silver chapter in "Mineral Industry") the production for this year, including 50,000 oz. recovered from material refined in the United States, was 4,312,770 oz. The causes of this notable increase in production seemed to be : First, the extension of the summer operations into the autumn ; secondly, the rapid expansion of production in the Urals (thus the Soviet Press reported that the three-quarter year output in 1934 was three times as great as for the corresponding period in 1933) ; thirdly, the rapid increase in mechanization in the mines ; relevant are the statements of A. P. Serebrovski that in 1913, 20 per cent, in 1926, 25 per cent, and in 1933, 70 per cent of the output of gold was mechanically produced.

1935.—In an article entitled "Russia" in the *Engineering and Mining Journal* for February, 1936, the estimate given for the 1935 production was 5,984,098 oz., plus 614,900 oz. refined in the United States, giving a total of 6,598,998 oz. H. N. Lawrie estimated the same year's output at 5,831,106 oz. and included in this an amount of 500,000 oz. recovered in the United States from high-grade material shipped for refining.

1936.—A recent article by Dr. R. J. Bridges in the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa for November, 1937, supports the contention of Arthur Notman, a former President of the Mining and Metallurgical Society of America, who said in July, 1937, that—

> such generally accepted authorities on metal data as the American Bureau of Metal Statistics, the Union Corporation, and Samuel Montague and Co., of London, have apparently approved the official Russian figures on gold production of recent years. The figure reported for 1936 by these authorities was about 7,350,000 oz.

but who went on to prove that this was an impossibility. Dr. Bridges gives as the figure a little over 5,000,000 oz. However, the *Engineering and Mining Journal* in an article "Soviet Union," February, 1937, gives a value of 7,300,000 oz. including 300,000 oz. refined in the United States, which checks with H. N. Lawrie's figure of 7,289,000 oz. and also with the figures above, to which Arthur Notman takes exception. Further, a statement in the May, 1937, edition of *The U.S.S.R. in Construction*, published in Russia, indicates an increase of 257 per cent for 1934 and 440 per cent for 1936 in the production of gold, when the 1930 output is taken as 100. Using these figures to determine the actual 1936 output, the following is obtained :—

> *Eng. Min. Journ.*, etc., 1934, 4,262,000 oz., gives 7,300,000 oz. for 1936 (cf. 7,289,000 above).
>
> South African article, 1934, 3,800,000 oz., gives 6,500,000 oz. for 1936, which is, however, considerably above the 5,300,000 oz. for 1936 estimated in the same article.

Sharp Decline Visioned

An additional agreement with the figure taken for the 1936 output is obtained from another statement in *The U.S.S.R. in Construction* that the gold and platinum enterprises in 1936 fulfilled the annual plan and achieved a 26 per cent increase on the 1935 output. Thus—

> *Eng. Min. Jour.*, etc., 1935, 5,831,106 oz., gives 7,350,000 oz. for 1936.

It does not seem likely that the same rate of increase will be attained in 1937 (Dr. R. J. Bridges, after a recent visit to Russia, thinks that "the results will show, if not an actual falling off in output, a very sharp decline in the rate of increase"), but there are three factors which will exert great influence in the attainment of increased output. They are the completion of the Taishet-Khabarovsk railway, which runs from 400 miles west of Irkutsk around the north-east of Lake Baikal and passes the important Balei and Darasun gold areas ; secondly, the intense development of the Stakhanovite movement in the industry, and, finally, the

efforts made by the Government to encourage people to go and work in those gold areas which suffer from a severe climate.

Gold Mines.—Production data and information on geological conditions and mining methods are not easy to obtain concerning the Russian gold deposits, but in what follows brief comments are made concerning some of the important mines and areas.

TABLE 1—SUMMARY OF THE TRANSVAAL, U.S.S.R., AND WORLD OUTPUTS OF GOLD, 1932 to 1936 (OZ.)

	1932	*1933*	*1934*	*1935*	*1936*
World	24,135,000	25,368,000	27,981,000	31,281,000	35,531,000
Transvaal	11,378,000	11,014,000	10,480,000	10,777,000	11,339,000
U.S.S.R.	1,990,000	2,667,000	4,262,000	5,831,000	7,289,000

Balei Gold Trust.—This area was established as having workable deposits in about 1929. The gold occurs in quartz and calcite stockworks in granodiorite; the veins are narrow but rich. In 1934 the production was about 140,000 oz. and in 1935 the output was supposed to have been doubled. Many mining settlements have sprung up in the dense Taiga in the last few years and the mines are reputed to be well equipped and highly mechanized. Clubs, theaters, creches, and hospitals have been established in order to induce workers to come to and remain in the area. The Stakhanovite movement and shock brigade workers are well established, one of their achievements being the driving of 100 meters through granodiorite in a month. Some of the Stakhanovite workers earn over 3,000 roubles a month. This appears exceptionally high in comparison with the 250 to 700 roubles per month earned by the Donetz basin coal miner and up to 1,200 by the Stakhanovite worker in the same area.

Darasun Gold Trust.—At Wokresensk quartz lenses occur in schist country rock, gold being associated with sulphides and tourmaline. At Darasun itself gold occurs in sulphide veins in association with pyrite, arsenopyrite, chalcopyrite, galena, etc., and is attributed to granite-porphyry intrusions.

Lena Gold Trust.—The Lena fields were, of course, known before the War and the alluvial deposits worked to a great extent, but the War retarded their development. Russian official figures show 5,120 oz. of gold to be the output annually by the foreign company holding the Lena concession in the years immediately following the War). The alluvials along the Lena are now worked largely with American steam and electric dredges excavating to a maximum depth of 60-ft. and having a bucket capacity of 5½ to 17½ cu. ft. (Fig. 2). These dredges operate during the whole of the year. Workings are also being developed underground and the new fields of Bolshoi Dogaldyn, Right Dogaldyn, Left Dogaldyn, the Yezhov, and Vassilyev will shortly be exploited. The output of the Lena fields increased in the period 1932 to 1936, due to the fact that the labor productivity increased by 195 per cent and also that the first section of the Mamakan heat and power station began operation.

Gold Dredge, Lena Trust

Kochkar Gold Trust.—This is near to Sverdlovsk in the Urals and the gold occurs in a coarse biotite-chlorite schist.

Mias Gold Trust.—Here the gold is found in lenses and veins in schists which are intensely sheared, the schists originating as volcanic tuffs. In the Tyelgin field a gold nugget of 960 oz. has recently been found. It is here that the system of socialist working in the form of Artels is well developed.

Minusa Gold Trust.—This is in the West Siberian Territory and in the Alatau Region at Artemovsk, gold being found in sulphide lenses and veins of the contact type in limestones.

Yakutsk Gold Trust.—Here are alluvial workings and mines. There have also been discovered a number of banket reefs similar to the Rand, but these have so far proved uneconomic to work. At Solataya Gora a gold deposit of from 5 to 10 dwt. per metric ton in the form of quartz-calcite veins carrying pyrite, chalcopyrite, and tetrahedrite is mined in schist country.

Ural Gold Trust.—The well-known Berezovsk deposits are controlled by this Trust. These are located about 14 km. north-east of Sverdlovsk; the area occupied by the deposits amounting to about 64 sq. km. The rocks of the region present a very varied character; thus both acid and basic igneous rocks dominate the exposures of effusive rocks, greenstones, and diabases, while Palæozoic sedimentaries are also present. The whole series of these rocks is crossed by a net of numerous dykes of granite-porphyries, syenite-porphyries, etc., with a predominantly north-south strike. The deposits are represented by enormous numbers of thin gold-bearing quartz veins crossing the dykes in an east-west direction.

Gold is found in these ladder veins and is either native or in association with pyrite, chalcopyrite, and galena. The pure quartz veins without sulphides, the carbonate-quartz veins containing sulphides, and the quartz veins with sulphides more often contain gold than the tourmaline, epidote, or hematite-quartz veins, which also occur.

II.—Base Metals

(1) ALUMINIUM.*—While bauxite has been reported as occurring in numerous localities in Russia, apparently the main deposits of commercial value are those situated in the Tikhvin district, which lies to the south-east of Leningrad, about 137 km. away. It is from this district that the major part of the ore comes which is used by the aluminium works at Dniepropetrovsk. These works utilize electric power generated by the Dnieper power station of 800,000 h.p. from a dam on the river giving a 37 m. head. In 1934 the output of bauxite was 60,000 long tons, in comparison with 530,000 tons from France. The bauxite areas are as follows:—

Urals. (Mesozoic).—Sokolovsky in the Kamensky district.

At Kainensk, an aluminium plant, of 25,000 tons per annum capacity, to take the Ural output, is being built.

Pershinsky in the Rzhevsk district.

Alapayersky.

(Palæozoic).—Krasnaya Shapochka in the Nadezhdinsky district. This occurrence is 10 km. from Vagran. Bauxite occurs at the contact of a pink-grey Upper Silurian limestone with a black Lower Devonian limestone in a belt 2 km. by 15 km. Composition is Al_2O_3, 56 per cent; SiO_2, 2.8 per cent; Fe_2O_3, 28 per cent.

Bashkir A.S.S.R.—Maloyazsky region.

Cheliabinsk District.—Siatka and Katorsky.

Tikhvinsky District.—Krasno-Roocheiski, Goobsko-Pochaevsko, Pidsosnenski, Osadinski, Segolski.

The Tikhvin deposits consist of a group of about fifteen separate units and the occurrence is remarkable for two particular features: First, that they occur between the 59th and the 60th parallels north, which is further north than any other known bauxite deposits, and, secondly, that their geological age—Lower Carboniferous—is older than any other known areas. The area was first discovered to contain bauxite in 1916 by P. Timofeev. According to R. J. Anderson†—

"The bedding conditions, the mineralogical and chemical compositions, and the geological structure of the region lead to the conclusion that the bauxites were formed by the lateritic decomposition of plagioclase felspars and the eventual deposition of the products by streams into lakes."

The colors of the bauxites vary from white to violet, while the structures are partly porous, partly compact, and frequently with a considerable amount of oolites consisting of oxides of iron

*For a recent summary of the Russian aluminium industry the reader may be referred to an article by Dr. R. J. Anderson appearing in the February issue of the *Magazine*.

†*The Mining Magazine*, July, 1929.

and aluminium. The range of compositions, in a general way, is as follows :—

Al_2O_2, 45 to 70 per cent ; SiO_2, 2 to 30 per cent ; Fe_2O_3, 3 to 25 per cent ; TiO_2, 1 to 3 per cent ; loss on ignition, 12 to 40 per cent.

Reserves of the Tikhvin Region.—As calculated by Russian geologists in 1929, the reserves were as shown in the accompanying table No. 3 (Anderson, *op. cit.*). The data are based on drill-hole and test-pit records and the grading is as shown in Table 2. Only the Prima grade is suitable for use in the Bayer aluminium process and its quality is inferior to what is normally desired and employed. The I grade would be suitable for aluminous-cement manufacture, but none of the grades is suitable for chemical purposes (aluminium salts), or for abrasives or high-grade refractories.

TABLE 2.

Grade	*Composition*	*Ratio*
Prima	.. Al_2O_3 more than 50%	SiO_2 less than 10%
I.	.. „ „ „ 50%	Ratio $\frac{Al_2O_3}{SiO_2}$ >3
II.	.. „ „ „ 40%	„ „ >2
III.	.. „ „ „ 30%	„ „ >1

TABLE 3

CALCULATED BAUXITE RESERVES OF THE TIKHVIN REGION (metric tons).

Grade	*Name of Deposit*					*Totals*
	Krasno-Roocheiski	*Goobsko-Pochaevsko*	*Pidso-snenski*	*Oosad-inski*	*Segolski*	
Prima	253,000	120,000	—	—	—	373,000
I	201,000	195,000	22,000	182,000	—	600,000
II	459,000	131,000	115,000	—	—	705,000
III	1,003,700	383,000	34,000	—	1,000,000	2,420,700
Aluminous clays .	—	3,000,000	1,192,000	—	—	4,192,000
Totals ..	1,916,700	3,829,000	1,363,000	182,000	1,000,000	8,290,700

The second Five-Year Plan ending in 1937 scheduled the completion of the Volkhov and the Dniepropetrovsk aluminium works, the latter being mentioned above. Further, a new aluminium plant was to be constructed at Kamensk in the Urals, with a capacity of 25,000 tons, and another in Karelia, with a capacity of 8,000 tons.

(2) CHROMIUM.—The chromite production of the U.S.S.R. in 1932 was 68,000 m. tons and in 1935, 217,000 m. tons. Relatively small reserves occur at the following places : Gologorsky, Khabarninsky, Mt. Verbluzhnya, Kraki, and Khalilovo, but the main reserves are in the Saranovskaya deposits in the Urals. These deposits have reserves totalling 7,000,000 m. tons of chromite, averaging about 35 per cent Cr_2O_3, and the annual production is of the order of 50,000 tons. Of this, about 20,000 tons of higher-grade material, about 38 per cent, is used for the production of potassium dichromate, the remainder being used as a refractory.

The Saranov mountain is made up of Lower Palæozoic quartz-mica-chlorite schists which are crumpled into steep folds in a north-south direction. The series is intruded by gabbros and peridotites which have been serpentinized and all are cut by diorite dykes. The ultra-basic bodies outcrop as two lens-shaped bodies striking north and south and dipping almost vertically. The length of the north, or main, outcrop is up to 9 km. and the width from 80 to 250 meters. The south outcrop, of similar thickness, extends a distance of 2 to 3 km. The ore zone within the boundaries of the main massif comprises three vein-like bodies—the west, the central, and the east zones. The strike lengths attain 760 to 820 meters and grounds are present for assuming a dip depth of 300 to 400 meters. The average figures of profitable thickness are : West, 4.3 m. ; Central, 9.2 m. ; East, 7.5 m., and the tenor of the ore in Cr_2O_3 is West, 36 per cent ; Central, 38 per cent, and East, 34 per cent.

In the west ore-body the transition between wall-rock and ore-body is gradual. Thus the chromite in the peridotite increases towards the ore-body, the pyroxene becoming replaced by chromite, resulting in rich disseminated ores. Further away the olivine is replaced by chromite and compact ore results in which a little serpentinized olivine remains with a segregation of chromite and admixed chloritized pyroxene.

(3) COPPER.—The information given here is taken mainly from Russian sources and probably errs on the side of optimism ; this opinion is enhanced by the fact that few of the geological congress excursions were to copper deposits, indicating the comparatively small reserves and mines. Table 4 gives productions for 1933 to 1936. The Russian copper reserves were estimated in 1936

TABLE 4

	1933	*1934*	*1935*	*1936*
World	1,137,400	1,387,700	1,603,100	1,796,500
U.S.A...	233,600	240,000	380,100	605,000
U.S.S.R.	36,000	48,600	69,400	89,000

to be 17,500,000 metric tons of metal and the second Five-Year plan (1933-37) contemplated an output of 100,000 tons per annum from the Balkhash Combinat (Kazakh S.S.R.) ; 50,000 tons from the Central Ural Combinat, and 80,000 tons from reconstructed old mills in the Urals and Trans-Caucasia—i.e., 230,000 metric tons per annum. From the above figures it does not appear that the scheduled production has been reached, although increased mechanization and more experienced miners increased the annual production considerably.

Major Deposits are Shown

The following are the major deposits :—

PYRITE ZONE OF THE URALS.—This follows the East slope from Kushva in the north to Bliava in the south. Thus from north to south there are Krasnouralsk, Kalatinsk, Degtyarka, Pyshminsko, Klyuchorsky, and Karabush.

Bliava.—This is said to have reserves of 3,000,000 tons of metallic copper in an ore averaging 4 per cent Cu. Large-scale production from this deposit is not likely until after 1938, although open-cast operations have been started.

Pyshminsko.—A new smelter was scheduled to be completed in this district at the end of 1937, thus increasing the total capacity of major smelters to 207,000 metric tons per annum.

Kazakh S.S.R. (Djezkazgan, Kounrad, and Almalyk).—(*a*) Djezkazgan.—In the Korsak-Paysky district. This is one of the largest deposits in the Union. Drilling has proved 3,250,000 metric tons of metallic copper, and the third Five-Year plan beginning in 1938 schedules the completion of a new smelter on the Kara-Kenshir River of 200,000 metric tons capacity. The ore averages 3.5 per cent Cu. and is found in lenses in areno-argillaceous sedimentaries overlying Lower Carboniferous limestones. There are two types of deposit : First, elongated lenses in sandstone, the ore replacing calcite cement ; secondly, columnar bodies filling fissures in fracture zones. Chalcopyrite, pyrite, and bornite are primary and hydrothermal, while tetrahedrite and the carbonates are secondary.

(*b*) Kounrad (near Lake Balkhash).—This is a porphyry copper deposit and contains 2,600,000 metric tons of metallic copper. A railway was completed in January, 1936, and open-cast operations have begun.

The first production was at the end of 1936.

(*c*) Almalyk (near Tashkent, along the Angren River).—This deposit is reported to contain 3,000,000 metric tons of copper.

Armenian S.S.R. (Allaverdy, Agarak, and Kafan).—(*a*) Allaverdy.—Here the ore-bodies occur in zones of rupture of Jurassic porphyries and tuffs and form thick stocks in quartzified rocks impregnated with gypsum, pyrite, chalcopyrite, and bornite.

(*b*) Agarak.—Development of a body similar to that at Greene, Cananea, Mexico, has disclosed copper-molybdenum deposits containing 800,000 tons of copper and 25,000 tons of molybdenum.

Altai Mountains. (Ridder and Sokolny, Zyrianovsk, Belousovsk, and Zmeinogorsk).—The metal reserves of the Altai Mountains are given by A. and E. Meyer in the *Engineering and Mining Journal* for September, 1936, as in Table 5.

TABLE 5

	Cu.	*Pb.*	*Zn.*	*Ag. (kgm.)*	*Au. (kgm.)*
Metric Tons ..	595,800	1,878,600	3,952,300	4,475,307	350,000

(4) LEAD AND ZINC.—Table 6 shows comparative productions. The following are the important regions in the U.S.S.R.

TABLE 6

LEAD AND ZINC PRODUCTION (short tons)

		1933	*1934*	*1935*	*1936*
Lead.	World	1,317,000	1,490,000	1,566,000	1,689,000
	Germany ..	128,500	132,200	134,800	158,500
	Russia ..	15,000	30,000	40,500	55,000
Zinc.	Russia ..	—	—	50,800	63,000

Tetiukhe, Far Eastern District.—This is one of a large number of deposits in the area. The ore-bodies are three in number and have a lens form from 0.5 meter to 15 meters thick and from 200 to 500 meters in both directions along strike and dip. The bodies occur in Triassic limestones and are genetically connected with a

quartz-porphyry intrusion. Typical contact suite of minerals is present: Galena, sphalerite, chalcopyrite, arsenopyrite, and tetrahedrite, along with tremolite and hedenbergite; chalcocite is present as a secondary mineral.

Sadon (in North Osetia A. R. in the Caucasus).—This is the largest lead-zinc deposit in the U.S.S.R. It is a mesothermal deposit having a thick rosary-like vein form and is associated with a Tertiary intrusion of a quartz-keratophyre dyke. Ore minerals are galena and sphalerite. Nerchinsk and Salair in the East Siberian Republic are other deposits.

Kazakh S.S.R. (Turlansky Group and the Altai Group).—(*a*) Turlansky Group.—This comprises deposits in the Karatau Mountains, the Achesai, and the Kara-Kan-Say deposits. They are of the metasomatic hydrothermal type and the bodies are of lenticular or tabular shape, occurring in tectonic breaks in limestone. A foot-wall zone of oxidation is present and the zinc content increases with depth.

(*b*) Altai Group (comprising the Ridder and Sokolny, Zyrianovsk, and Zmeinogorsk groups, and the Belou-sovsk mine).—From the article by A. and E. Meyer previously cited, the lead and zinc reserves of the Altai Mountains in 1936 were: Lead, 1,878,600 m. tons; zinc, 3,952,300 m. tons.

Ridder and Sokolny.—In 1936 the zinc reserves were given as 70 per cent of those of the Altai and 30 per cent of those of the U.S.S.R., while the lead reserves were 80 per cent of the Altai and 35 per cent of those of the U.S.S.R. The Ridder deposit is 310 meters long, 175 meters along the dip, and up to 4 meters thick, the dip being variable from 0 to 75°. It occurs in Lower Devonian sedimentary rocks occupying an area of 355 sq. km. A metamorphic series is present under the Devonian and a granodiorite massif borders these rocks on the north-west. It is cut by numerous quartz-keratophyre dykes from which the mineralizing solutions came. The foot-wall is highly silicified and the hanging-wall is of an argillaceous character.

Orjonikidze Mill, Balei Mines

The Sokolny deposit consists of seven lenses 50 to 150 meters long by 30 to 50 meters wide which vary in thickness from 7 to 35 meters. Reserves are given in Table 7.

TABLE 7

Ore-Bodies	Reserves	Grade			
	Sulphide	*Cu.*	*Pb.*	*Zn.*	*Ag.*
Ridder	1,246,000	1.32%	15.18	28.81	248 gms./m.ton.
	Impregnated 5,179,000	0.38%	2.49	5.05	25.4 ,,
	Both				
Sokolny	6,397,000	0.8%	4.6	6.5	98.5 ,,

As a result of diamond-drilling operations the reserves were increased in 1935 to a total of 31,633,500 m. tons.

Zmeinogorsk Group.—These mines are situated at about 90 km. east of Rubtzovka, on the Turkish-Siberian railway, the deposits occurring in Middle Devonian rocks between two great granitic intrusions. The sedimentaries are faulted and intruded by quartz porphyries and keratophyres to which the ore-bodies bear a genetic relationship. At Zmeinogorsk there are two bodies—the "Great" and the "Kaminsk," which, on surface, are 280 meters and 75 meters long respectively. The dip is from 40 to 60° and the 30 to 50 meters thick lenses have been worked to a depth of 220 meters. The ore reserves in 1936 were estimated at about 2½ million tons of the following composition: Pb., 1.5 per cent; Cu., 0.3 per cent; Zn., 2 per cent; Au., 1.5 gm. per ton; Ag., 50 gm. 1 m. ton.

Belousovsk.—This mine is situated about 17 km. north-north-west of Ust-Kamenogorsk, but is as yet only under development. In an area highly altered by regional metamorphism and metasomatism a number of parallel lenses occur along a strike distance of 2,200 meters, between a hanging-wall of sericite-quartz schists and talc schists, and a foot-wall of carbonaceous and clayey phyllites. The lenses vary from 0.5 meter to 15 meters thick and the intervening barren rock sheets from 0.3 meter to 3 meters. The ore pinches out at a depth of 150 meters to 250 meters. The Belousovsk reserves in 1934 are shown in Table 8.

TABLE 8

BELOUSOVSK RESERVES IN 1934

	Tons.	*Cu.*	*Pb.*	*Zn.*
Proved	5,000,000	3.36%	1.66%	7.57%
Probable	1,500,000	3.20%	1.97%	11.00%
Possible	4,000,000	2.00%	1.50%	8.00%

The second Five-Year plan scheduled the completion of the Kazpolymetal works with an output of 60,000 tons of lead per annum and the erection of smelters at Cheliabinsk and Ordjonikidze.

Zyrianovsk.—The Zyrianovsk deposit is associated genetically with quartz porphyries which intrude intensely folded slatey tuffs, argillaceous slates and micaceous quartzites. There are two distinct bodies dipping towards each other at 75°. The north ore body has been opened up for about 600 meters along the strike and to about 230 meters in depth. The thickness of the bodies varies from 6 meters to 35 meters, out of which 1 meter to 12 meters is sulphide ore, the remainder being so-called impregnated ore. Reserves are shown in Table 9.

(5) MAGNESIUM.—The reserves of magnesium ores are of two different types—the carnallite deposits and the magnesite deposits.

TABLE 9

ZYRIANOVSK RESERVES

	Reserves	Grade				
	Sulphide	*Cu. %*	*Pb. %*	*Zn. %*	*Au.*	*Ag.*
					gms/ton	
Possible	389,000					
Probable	170,000	2.7	11.7	22.6	9.5	470
	Impregnated					
Probable	1,866,000	0.4	1.5	3.3	0.8	27

Carnallite Deposits.—

Solikamsk (Sverdlovsk R.).—These deposits are very extensive and comparable in size to those at Stassfurt in Germany.

Magnesite Deposits.—

Shabny (Cheliabinsk R.).—This is a talc-magnesite deposit.

Satka (Cheliabinsk R.).—This is the largest of a group of four deposits of crystalline magnesite, the others being the Bakal, Katav-Ivanovsk, and the Beloretsk deposits. Satka itself consists of 12 deposits, of which the Karagai is the largest, all of them occurring in black, marmorized, and partly-brecciated dolomites, with which they lie conformably. These deposits are the principal base for the magnesite industry of the U.S.S.R. and for the last ten years magnesite has been exported to England, Germany, and France. Mining and transport are mechanized and electrified (blasts of 30,000 tons take place about 10 times a month in the Karagai quarry) and the construction of a large new dressing plant is nearly

completed. The output of the Satka group had increased to 800,000 to 900,000 tons of magnesite annually in 1936.

The deposits vary from a few hundred meters to 2 km. in strike length, from 60 to 300 meters in the dip direction (20 to 40° dip), and are up to 110 meters thick. The magnesite is normally a medium-grained, but sometimes large and coarse-grained rock, grey or blue-grey in color and the chemical composition of that at Karagai is given by the following analysis :—MgO, 45.5 per cent ; CaO, 1.0 per cent ; SiO_2, 1.0 per cent ; Fe_2O_3, 1.5 per cent ; CO_2, 50.9 per cent.

(6) MANGANESE.—The Russian reserves and production of manganese ore are very considerable. Thus, in 1931 the reserves were estimated by P. I. Vasilenko to be 398,000,000 metric tons of ore in the Nichopol area alone.

In 1932 the *Engineering and Mining Journal* estimated a production of 915,000 metric tons ore from all U.S.S.R.

In 1932 the Russian figures gave an output of 953,840 metric tons from Nichopol alone.

In 1936 the planned production was 2,700,000 metric tons from all U.S.S.R.

Large Manganese Deposit

The chief areas are as follows :—

Chiaturi (in the Georgian S.S.R.).—This deposit is near to the Kvirilla River and is one of the largest deposits in the world. It extends over an area of almost 32 sq. km. and has a thickness of 2 meters to 3 meters. It is a typical sedimentary deposit of psilomelane and wad and occurs in oolitic form together with much intercalcated dusty ore and arenaceous bands.

Urals (Cheliabinsk River, at Verkhne-Uralsk and Magnitogorsk, Urazovsky, and Nazgalovsk and Ayusazovsky).—The ore-bodies here occur as pockets and veinlets, which generally dip steeply, in brecciated zones and small faults in jasper rocks.

Bashkir A.S.S.R., the Azov-Black Sea Region, and West Siberia also have deposits.

Nichopol (in the Ukrainian S.S.R.).—The manganese deposits are situated near the Dnieper River, below the town of Zaporozhie, the new industrial center built to absorb power from the Dnieproges power station previously mentioned. At the present time, eight mining boards control 25 to 30 mines in the district. The geology of the area consists of an irregular south-dipping platform of pre-Cambrian rocks (hornblende gneisses, amphibolites, and biotite gneisses) and, in some localities, large granite massifs, in the depressions of which the manganese has been concentrated. Resting on the irregular crystalline surface, or on the products of its weathering, are the Palæogene deposits to which the manganese deposits are confined. Thus—

(*a*) The beds underlying the ore-horizon, developed fully in the west are characterized by a light-green compact clay with siliceous cement, usually of small thickness.

(*b*) The ore-bed occurs more or less continuously over both the east and the west area and varies in thickness from 1.5 meters to 3 or 4 meters (rarely 5.5 meters). It is a black clay, occasionally arenaceous, saturated with powdered manganese ore (soot). Compact nodules and oolites of manganese ore are present varying from a few millimeters to 25 cm. in diameter.

(*c*) Beds overlying the ore horizon are normally green compact clays with sand partings. The ore deposits are in two sections—the west and east. The latter are the more important and the following are details concerning individual deposits :—

Breia ravine, 2 km. by 5 km. ; Gorodishchensky mine, 2 km. by 1.5 km. ; Comintern lot (nearly exhausted) ; Marievka lot ; the Voroshilov and Khataevich mines ; Pervomaisky mine, 2.5 km. by 1.5 km. ; Grushevka deposit, 4 km. by 3 km. The ore types consist of—

(*a*) Oolitic ore in which oolites vary from less than 1 millimeter to 25 cm. in diameter.

(*b*) Earthy ore black or red-brown in color and often having a sand and clay content.

(*c*) "Crackling" or "flaggy" ore which is concretionary and of irregular shape with cellular surface. It is tough and heavy and represents oolitic ore cemented by more or less tough ore-material.

(*d*) Concretionary ore of irregular shape honeycombed and porous. It is relatively light and represents concretions formed by barren rock cemented by ore.

(*e*) Mineralized limestones.

The minerals present are : Pyrolusite ; psilomelane ; wad ; polianite, and, rarely, limonite, manganite, and hæmatite. The crude ore runs 20 to 36 per cent of metallic Mn., averaging 30 per cent ; the concentrates 36 to 52 per cent, averaging 45 per cent.

In the Voroshilov shaft No. 12 the ore-bed is met with at a depth of 85 meters and has a thickness of 2.5 meters, averaging 32 per cent metallic Mn. The ore is mined in panels of 100 to 150 meters by 25 meters and complete extraction is effected. The mine produced in 1937 about 1,500 tons of ore a day. The ore is beneficiated by crushing and simple trommel washing, up to a content of 45 per cent Mn., the tailing giving about 9-10 per cent loss of the total Mn. present in ore. Normal workers produce 650 to 750 tons per month and are paid considerably less than the Stakhanovite miners, who produce anything up to 1,200 tons per month. The working hours are seven per day and five days are worked out of a week of only six days. Wages are as follows : Drillers, 15 to 35 R. per day, the higher figure being the Stakhanovite worker ; timbermen, 20 to 24 per day ; average underground, including the women trammers and loco drivers, 14 to 18 R. per day. (*N.B.*—£1—26 R., but the buying power of 1 R. is not $£\frac{1}{26}$.)

(7) NICKEL.—The Russian nickel reserves are low and the imports of the metal seem to be increasing. Thus, in 1935, 6,140 tons was imported and in 1936 8,500 tons. The known deposits include—

(*a*) Kola Peninsula and Monche Tundra. Here a low-grade nickel complex is under development. This is presumably similar, although lower in grade, to the deposit being opened up by the Mond Nickel Co. at Petsamo, in North Finland. This occurs in a pyroxenite peridotite complex in phyllite country. The ore reserves in Petsamo of an approximately 3 per cent Ni. ore are of two forms : Breccia ore and disseminated ore (the phyllite is also mineralized, but is of too low a grade to be exploited). Pyrrhotite and pentlandite are the chief minerals present.

(*b*) Ufalei deposit, in the Sverdlovsk Republic.—This is a deposit of garnierite producing about 10 tons of nickel a day. The reserves are small.

(*c*) Orsk-Khalilovo Region (Aktiubinsk Group, Novo-Akkerman, Aidyrla).—Secondary silicate nickel ore deposits formed by the weathering of ultra-basic rocks occur in many places in the South Urals. Chief are : Khalilovo, the Aktiubinsk group, where an ancient weathering mantle is spread over the surface of a serpentine massif. The deposit occupies an area of 1 sq. km. The surrounding rocks are serpentinized peridotites of the harzburgite type, among which dunites are distributed in the form of schlieren and vein-like masses. The peridotites are intrusive into variegated Lower Silurian slates. The ore-bodies themselves are zoned, the upper part being a friable, olive-green to black mass having little or no texture and characterized chemically by an almost complete elimination of Mg.—i.e., MgO less than 4 per cent partial elimination of SiO_2, and an accumulation of FeO, Al_2O_3, and nickel oxide. No individual minerals are observable. The ore masses grade below into less-altered serpentines ; the MgO is up to 10-12 per cent, the Fe_2O_3 falls to 10 per cent, and the SiO_2 increases to 72 per cent (zone of silicification). The nickel minerals are garnierite and the revdinskite group, together with veinlets of a nickel-containing opal. The ore-formations are 1 km. to 7 km. thick, depending on the irregularities of the underlying rocks.

Novo-Akkerman Deposit

This is situated 30 km. west of the town of Orsk and is one of a series located in fissures and shear zones among the serpentines. The deposits lie near the contact of a serpentinized massif of Lower or Middle Carboniferous age with effusive diabases and spilites of Lower and Middle Devonian age, these latter being partly super-imposed by siliceous slate and limestone of Upper Devonian or Lower Carboniferous age. A zone of disruption between the serpentines and spilitediabase series has favored the intrusion of a zone of olivine-gabbro and gabbronorite rocks, which are differentiated, the gabbro-norite forming the marginal parts. The ores are represented by a zone of alteration products of serpentines and drilling has indicated that the zone expands at a depth greater than 50 meters. Alteration of serpentine and nickel mineralization spreads along the fissures in the brecciated part of the serpentine massif in a zone 3 km. long. Types of ore are : Quartz iron ore, which is a friable and schistose ochre enclosing quartz blocks (proved to be present, from borehole evidence, to a depth of 100 meters),

nickel hydrosilicates (revdinskite chiefly) which occur in small veinlets, and a second type, consisting of slightly-altered serpentines with stockworks of garnierite and nickel chalcedony.

Aidyrla Deposit.—This is one of a number located in Karst gaps in the areas of the contact between serpentines and limestones.

(8) TIN AND TUNGSTEN.—The reserves of the U.S.S.R. in tin are very small and practically the whole of the metal is imported. Thus in 1935, 8,175 tons and in 1936, 11,000 tons were imported. The following is a very brief outline of the principal deposits.

Pshanja-Say.—This is a tributary of the Jagrov River. The ore occurs in limestone; arsenopyrite, pyrrhotite, chalcopyrite, cassiterite, scheelite, galena, and carbonates are the principal minerals present.

Djidinsky.—Here is an area of greisenized granite (4 km. by 1 km.) and metamorphosed sedimentaries occur, veins containing wolfram, galena, and, rarely, sphalerite.

Mt. Sherlovaya.—Greisenized granite occupies an area of 1 sq. km. and lodes contain cassiterite, ferberite, molybdenite, and arsenopyrite, along with beryllium and topaz.

Khapcheransky in the Kyninsky District of Eastern Siberia.—Here occurs one of the largest deposits. A granite intrusion into shaly sandstones has given rise to veins carrying cassiterite, a little wolfram, and sulphides.

Gumbeika Deposits.—These are situated at about 40 km. east of Magnitogorsk and are important more for their tungsten content rather than tin. Granitic intrusions of the granodiorite-diorite group, accompanied by dykes of granite-porphyry, occur in an area of jasperoid and siliceous schists overlain by effusive andesitic rocks and again by Lower Carboniferous limestones. The tungsten deposits are confined to the apical parts of the intrusive bosses and form a meridional ore zone extending over an area of about 30 km. The deposits are of two types: The quartz veins and also the scheelite concentrations within the limestones forming the contact aureole around the intrusion. The first type is represented by four deposits, Buranovsky being the chief. These deposits containing scheelite are known to number at present over 39 similar veins, averaging 0.2 meter thick and extending along the strike for 1,000 meters. The second type is represented chiefly by the Balkansky deposits, which occur as pockets among the carbonate rocks. The deposits are not rich enough to be worked under the conditions obtaining outside Russia, but under the Soviet plan of self-sufficiency and socialist working they constitute an important reserve.

III.—Iron

The iron-ore resources of the U.S.S.R. are enormous and an intense effort is being put forward in order to develop them fully. Thus the planned output for 1937 was 34,000,000 metric tons, a very great increase on the 21,000,000 metric tons of ore which was the estimated production in 1934. The program of the second Five-Year plan included the completion of the Magnitogorsk plant, with an output of 2,700,000 tons of pig-iron per annum; of the Kuznetsk plant, with an output of 1,000,000 tons of iron; of the Zaporozhye plant, the Azov Steel plant, the Krivoy Rog plant, the Tula plant, the Lipetsk plant, and the Petrov-Zabaikal plant. Further, the Tagil plant was to be completed to half its capacity, two blast-furnaces at the Baikal plant were to be started, and construction was to be advanced on the Khalilov plant and the second Kuznetsk and Far Eastern plants. The main ore resources are in—

(*a*) Ukraine: Krivoy Rog, Korsak Mjila, Kerch peninsula (in the Crimea),

(*b*) Urals: Tagil Kushvinsky Group (Mt. Blagodat, Mt. Vysokaya), Cheliabinsk R. (Mt. Magnitnaya, Mt. Bakalsky, Kusa), Orenburg R. (Khalilovo). Also Auerbach, Voronzotvsky, Pokrovsk, etc.

(*c*) Central R.: Tula-Lipetsk, Khoper, Kursk.

(*d*) Bashkirian A.S.S.R.: Beloretzsky.

(*e*) Western Siberia: Kuznetzk R.

(*f*) Far Eastern District: Malo-Khingansky.

(*g*) Kazakhstan, the Caucasus, Kola peninsula, and Central Asia.

(*a*) *Ukraine*: Krivoy Rog Deposits.—These are located in the Dniepropetrovsk A., where they trend in a narrow zone for about 100 km. north-north-east. The rocks constituting the district are of Permo-Carboniferous age and may be divided into two groups: First, an older group represented by gneiss, granite, and greenstone rocks; secondly, a younger group, less metamorphosed than the first, which it unconformably overlies, represented at the base by arkose sandstones and conglomerates, higher up by phyllites, talc schists, and chlorite and amphibole schists alternating with ferruginous and barren cherts, ferruginous cherts, and jaspilites, enclosing ore deposits, and, finally, at the top, by slates, shales, and dolomites.

The first group, which belong to the Teterev-Bug series of the Archean, are completely dislocated in a north-westerly direction and traversed by a number of granite intrusions, one of which, a large massif of plagioclase granite, is strongly developed at Krivoy Rog, to the east of the series. The second group comprises a series belonging to the Algonkian system, called the Saksagan series, and is dislocated in a north-north-easterly direction, forming very steep and highly-compressed eastwardly-reversed folds, which are occasionally disrupted, having their westerly limbs thrust upon their eastern. Due to this intense folding the jaspilite and ferruginous chert bed is repeatedly exposed at the surface and only recent work has shown that in reality only one stratigraphical horizon is thereby represented. The old names have however been retained and are as follows:—

First Saksagan band, which is about 29 km. long but of insignificant thickness, although it carries high-grade ore.

Second Saksagan band, which has a more complex form and reaches 400 meters to 500 meters in thickness. This is the most important band, 75 per cent of the high-grade ores of the region being associated with it.

Chervono-Kompaneiskaya band, which is similar to the first Saksagan band and includes small pockets in the band of high-grade ore.

The Gleyervatya band, the Chervonaya band, and the Tarapakovskaya band are small.

The Likhmanovka band converges in the north with the Tarapakovskaya band and has been traced for over 32 km. This band is second in importance and encloses considerable reserves of high-grade ore.

The chief bodies worked are of three types:—(1) Huge chimney-like, or, occasionally, pocket-like ore-bodies confined to the beds already mentioned. The dimensions depend upon the thickness of the jaspilite bed and the intensity of mineralization. The latter reached its maximum intensity in the second Saksagan band and ore-bodies vary from 100 meters to 500 meters (even 1,000 meters) in strike length and in thickness from 15 meters to 30 meters (rarely, 40 meters and even 100 meters). The horizontal sectional area of a number of parallel bodies normally remains constant to a depth of 350 meters, to which in some cases they have been traced (maximum depth, 560 meters). The minerals are chiefly martite (hæmatite only rarely occurring), limonite, which is present to considerable depths (300 meters in some cases), and, occasionally, siderite and carbonates.

(2) Bedded bodies, 1 meter to 12 meters in thickness and trending for several kilometers, consisting of hæmatite and martite, the former being the predominant mineral, struck at a depth of 400 meters and, in one case, at 1,142 meters.

(3) Magnetite bodies of irregular shape and small size, confined to the hornblende schists and ferruginous hornblende cherts and associated with wall-rock alteration to alkali-hornblende, ægirite, albite, and biotite rocks. Genesis seems to be due to the activity of hydrothermal solutions, alkaline in character, leaching the quartz out of the jaspilites and ferruginous cherts and depositing in its stead magnetite and certain other minerals.

Soviet Ore Output

Statistical information concerning the output of iron ore from the U.S.S.R. and Krivoy Rog in particular is as follows:—

Russian production in 1934 was 21,000,000 metric tons and planned in 1937, 34,000,000 metric tons.

Krivoy Rog production 1936 was 14,000,000 metric tons and planned in 1937, 20,000,000 metric tons.

The output is obtained from 37 major mines producing in following order:—

One mine more than 6,000,000 metric tons per year; six less than 2,000,000, and 30 less than 500,000 metric tons per year.

In Krivoy Rog the ore types are—Martite and red iron ore, 75 per cent of total ore-bearing area; magnetite ore, 7.6 per cent;

(Continued on page 270)

Formosa's Hydro-Electric Power Station*

TOWARDS the end of 1935 an order was placed with the AEG for the entire equipment of the Suiriko hydro-electric power plant of the Taiwan Denryoku K.K. of Taiwan (Formosa). This comprised two vertical alternators each with a capacity of 23,300 kva, the appertaining Francis turbines of 30,000 h.p. output, and the requisite apparatus for automatic operation, which enable each machine set to be started up and connected in parallel by means of one operating switch only.

Each of the Francis turbines, which were supplied by Messrs. J. M. Voith of Heidenheim, Germany, was designed for a rated output of 30,000 h.p., a rated speed of 360 r.p.m. and a runaway speed of 665 r.p.m. The effective head available is 403-ft., the maximum water capacity of each turbine being 7,350 cu.ft. The maximum momentary speed rise when full load is instantaneously thrown off is 16 per cent of normal speed, and the maximum pressure rise 10 per cent of normal pressure. For this reason a pressure regulator was necessary. A rotary valve was selected as shutting-off device. The spiral casings, together with the built-on rotary valve, were tested with the double working pressure, i.e. 355 lb. in.^{2} at the erecting shops of Messrs. J. M. Voith. This pressure test was repeated on site with the ready-mounted spiral.

The turbines, governors and rotary valves selected are of J. M. Voith's design, such as have proved satisfactory in many other installations.

The characteristic data of the synchronous generators are briefly as follows: Continuous rated output 23,300 kva at 0.9 power factor, generated voltage 11,000-volts, three-phase, 60-cycles. Rated speed 360 r.p.m., and fly-wheel effect, WR^2, 1,800,000 lb.-ft.^{2}. The machines are star-connected. The short-circuit ratio is approx. 1.25; and the charging capacity at 9,000-volts is 15,000 kva at zero power factor.

The general arrangement of the machines is that usually adopted by the AEG for vertical alternators of similar size. The total weight of the rotating parts including the hydraulic thrust on the runner, amounts to approximately 130 tons, and is carried by the thrust bearing located in the top bracket. This bracket is supported by the stator casing which, in turn, rests on foundation caps.

The generators are of the enclosed type, with internal ventilation. The cooling air enters from below into the machine. The hot air passes through openings in the stator casing into the surrounding air jacket, and thence through a metal duct into the open air. There was no particular need for filtering the cooling air. By favorably designing the ventilation paths and amply dimensioning the active material, it was possible to maintain the temperature rises measured on the test bed, and during the test on site, appreciably below the values guaranteed. This is the more remarkable because, although the customer specified the winding insulation to comply with Class B of the Japanese Standards, only temperature rises according to insulation Class A were admissible (Temperature rise in the stator winding: 55° C, in the field winding: 60° C).

Generators Have Auxiliaries

Each generator has its own built-on main and auxiliary exciters. In the event of a failure of the built-on exciter set, the excitation is switched over to a stand-by exciter unit driven by a motor. For keeping the three-phase voltage constant, a Tirrill regulator is installed in each field circuit of each auxiliary exciter.

The stator frame is of the usual fabricated wrought iron construction, and is split in order to facilitate transport. The double-layer winding consisting of former-wound coils is laid in open slots. Each coil contains several micanite insulated turns, each of which, again, is subdivided into individual conductors which are insulated with asbestos. The part of the coil lying in the slot is encased in a strong insulating layer of micanite ironed on hot. The coil ends are further insulated with cambric tape. The assembly and the advantages of former-wound coils are described elsewhere.

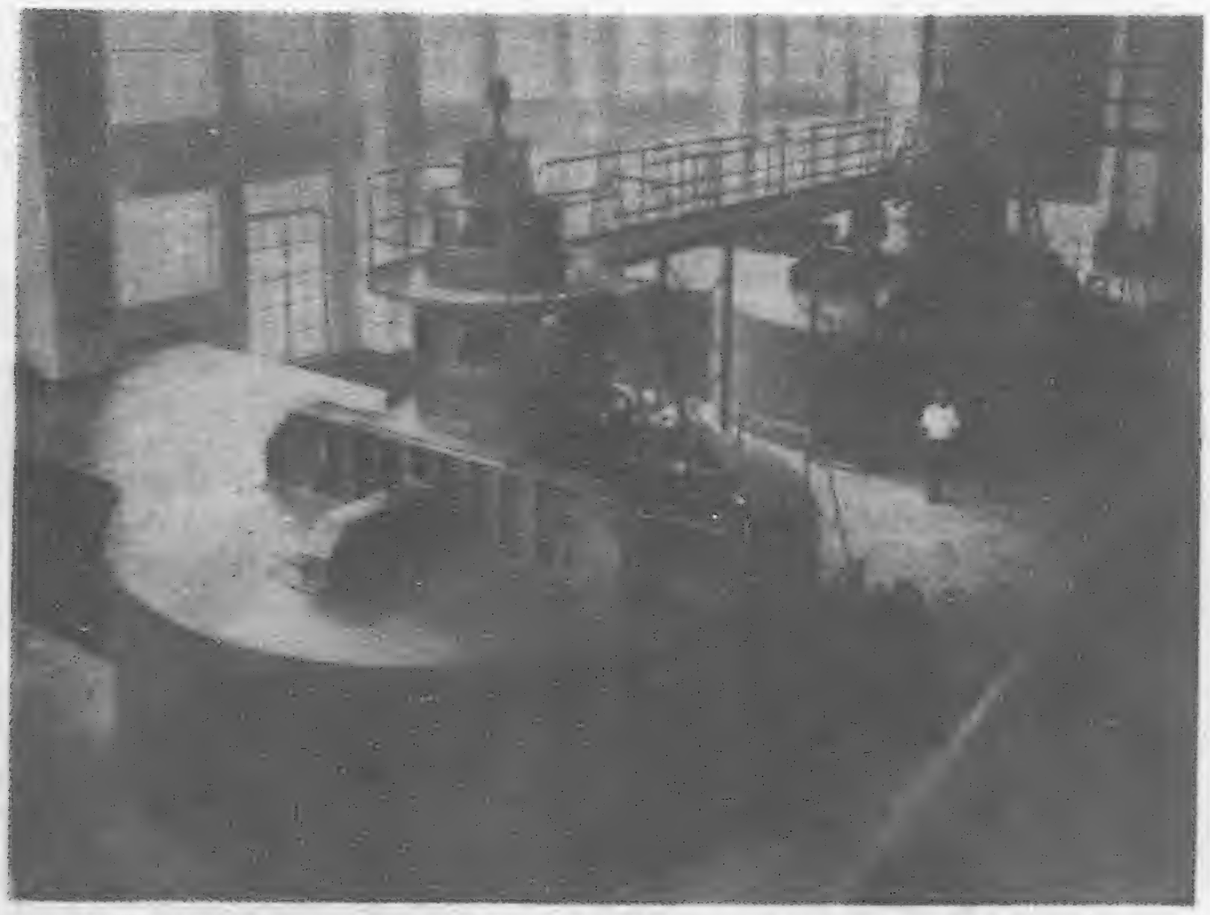
The rotor consists of a cast-steel boss shrunk onto the shaft; on this boss a cast-steel ring with cast-on poles is shrunk. On account of the maximum weight of 25 tons permissible for transport, this ring had to be split diametrically. The solid pole shoes are securely bolted to the pole cores. They are interconnected on both faces by copper rings which form an effective damper winding.

The field coils are wound of copper strap on edge which is insulated with asbestos. By adopting a special winding process it has been achieved that individual turns project beyond the winding (Fig. 4), whereby the cooling surface is appreciably increased. The entire field winding is then firmly compressed under high pressure at a suitable temperature and forms a compact unit. Deformations due to the high stresses set up, particularly when the turbine runs at runaway speed, are out of the question.

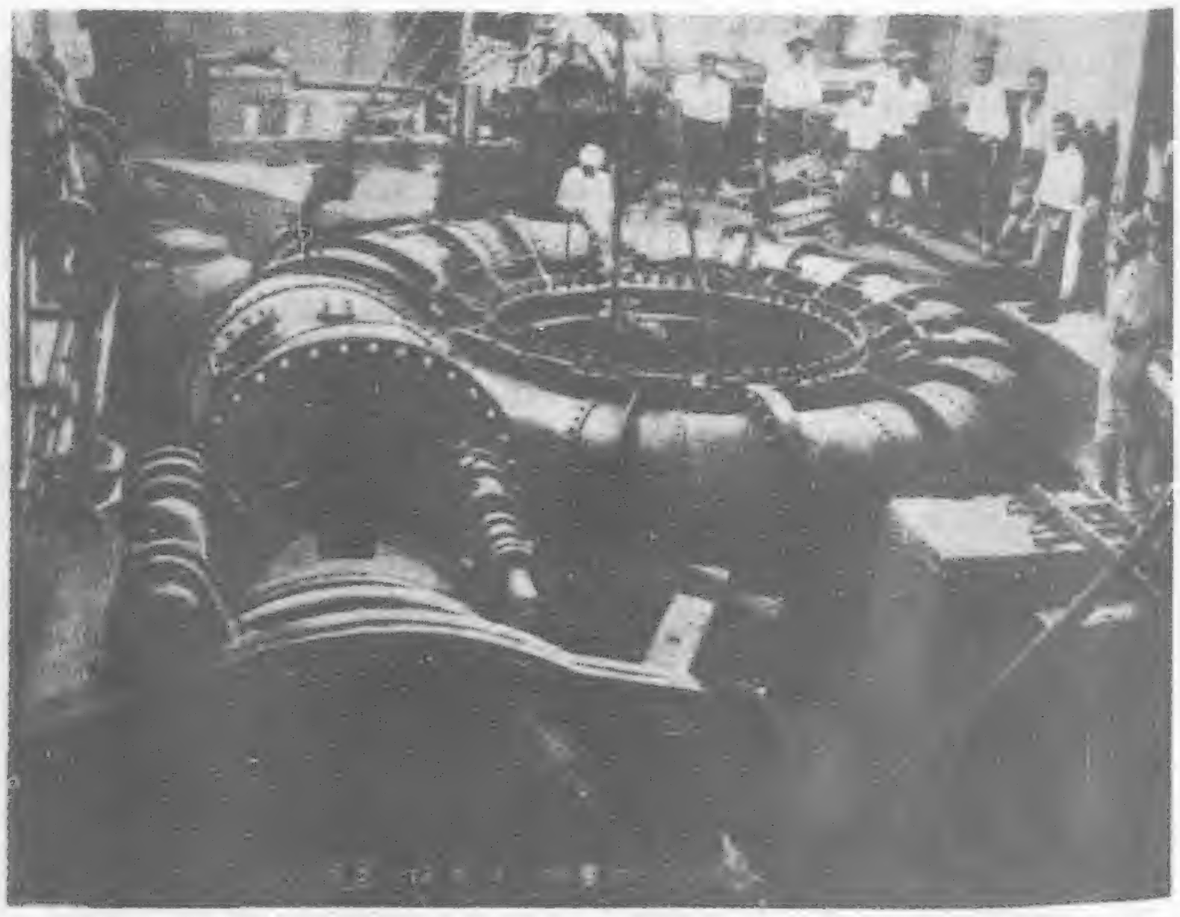
Each rotor was tested in the overspeed pit for two minutes at a runaway speed of 665 r.p.m.

For braking the generator, four oil-pressure braking cylinders are fitted to the lower bracket. These are connected to the main oil pressure system, and can be operated either by hand, or automatically in case of a break-down. The braking period is approximately

* From *AEG Progress*



Two alternators, each for 23,300 kva, 11 kv, at 360 r.p.m.



Spiral casing of the 30,000 h.p. Voith turbine during its erection at the Formosa station

five minutes. Provision is made for automatic braking to take place only after the rotary valve is closed and the oil circuit-breaker opened. After changing over from the central pressure oil system to a special, manually operated pressure pump, the braking cylinders can also be used for jacking the rotor.

Each machine set is equipped with a central oil supply system comprising a 22 h.p., three-phase motor coupled to an oil pump for the thrust bearing, an oil pump for the three guide bearings, and a pump for the pressure oil of the turbine governor, pressure regulator and rotary valve ; as well as with the requisite containers, the air vessel, etc. An auxiliary oil pump set, coupled to a 22 h.p. Pelton turbine, is provided as a stand-by for each unit. This starts up automatically should the motor-driven oil pump unit fail, and takes over the entire supply of oil without any interruption occurring. The oil supply for the three guide bearings of each machine set is obtained in common from a high level tank situated beneath the exciter platform. The oil flows from the guide bearings to allow level tank, whence it is pumped again into the high level tank by the above-mentioned oil pump. Double labyrinth glands and special air pressure seals situated beneath these glands very effectively prevent any leakage of oil or oil vapor.

Means of Protection

Protective devices. Particular stress was laid on the protection of the alternators. Therefore, each alternator has been equipped with the following protective devices :

- Differential protection.
- Earth leakage protection.
- Winding short-circuit protection.
- Definite over-current time-lag release.
- Protection against continuous thermal overload of the machine and against prolonged single-phase loads.
- Over-speed protection.

If any one of the above-mentioned protective devices should operate, the turbine and the alternator will immediately be disconnected, and the field weakening device be switched in at the same instant.

As regards the earth leakage protection, it should be mentioned that, in accordance with Japanese practice, the neutral point of each alternator is earthed through a resistor of approx. 20 Ohms only. Consequently the current flowing through the alternator winding in the event of an "earth" will be comparatively high, and will cause the earth leakage trip to disconnect the machine set immediately.

The other supervisory control apparatus and instruments, such as bearing thermometers, oil pressure relays, etc., only give a signal on the occurrence of a fault.

The temperatures of bearings and windings can also be measured by means of an electric temperature measuring apparatus mounted on the switchboard, apart from the built-in thermometers.

Starting Up and Shutting Down the Machines

Each machine unit can be started up by operating one switch only. In order to facilitate locating a fault in the event of failure within the automatic equipment, the starting process had to be subdivided into the following sections :

(1) Starting up the central oil supply system.
(2) Opening the rotary valve.
(3) Starting up the machine by opening the guide vanes.
(4) Synchronizing the generators and putting under load.

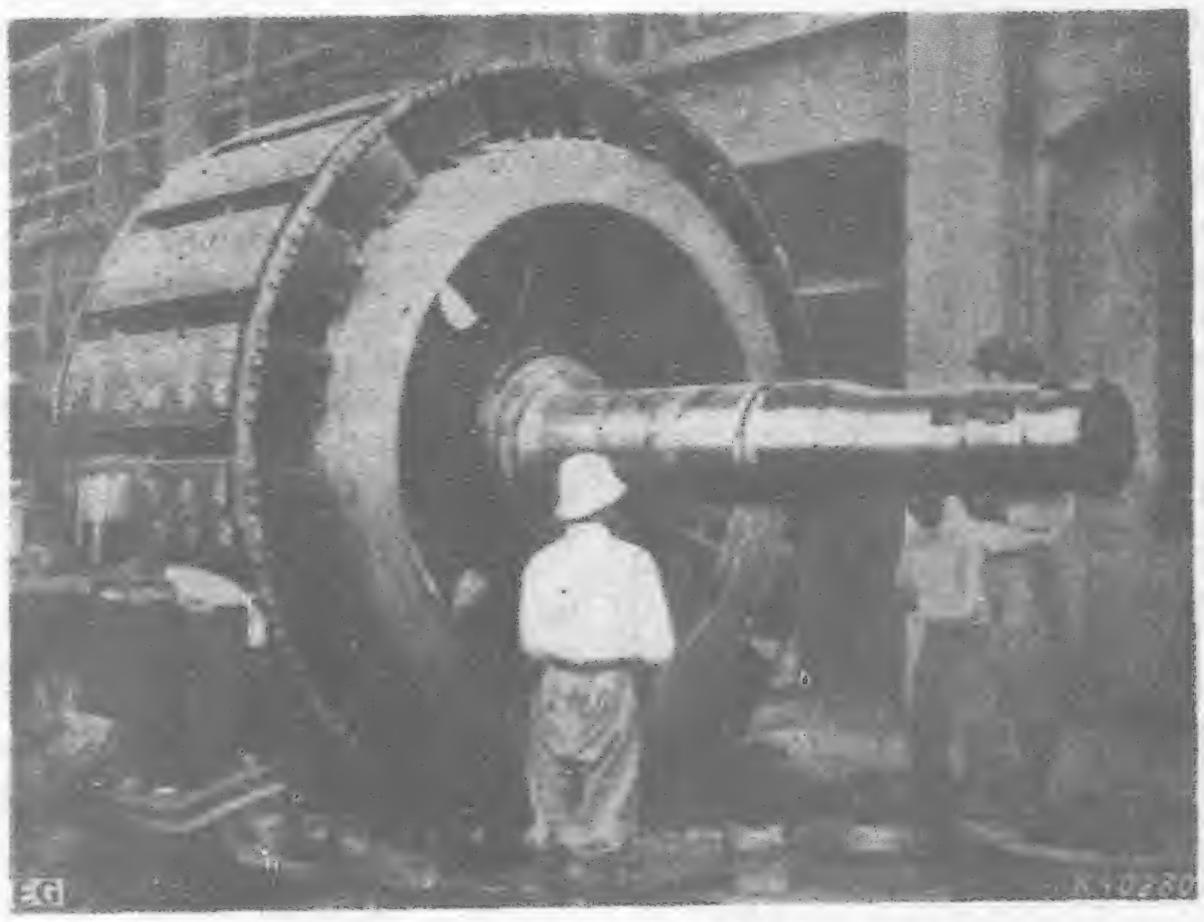
After each starting stage the starting process can be interrupted.

A red signal lamp is provided on the switchboard to indicate the completion of each starting stage. The following method was selected by the AEG, and was approved of by the customer, namely : Instead of various pushbuttons, a manually operated drum controller was provided for each machine unit ; for the different positions thereof the individual starting stages are clearly separated and indicated ; the correct switching sequence is safeguarded, and wrong switching by the operators avoided. Under normal working conditions, the drum controller can at once be turned to position 4. In so doing, the starting stages, described hereafter, are automatically carried out in due succession until synchronization of the generator is completed. However, the switching of the drum to the next position may also be delayed until the signal lamp on the switchboard has indicated that all switching operations of that particular stage are completed.

Starting-up and shutting down each machine unit is carried out as follows :

Starting Up the Machine Set

Position 1 of the drum controller : The field weakening breaker cuts in. The motor-driven oil pump starts up, and the oil circulation at the guide bearing and the thrust bearing begins. At the same time the requisite working pressure is produced by the oil pressure pump. When the predetermined working pressure in the air vessel is attained, the fact is indicated on the switchboard. If, from any cause, the current supply to the oil pumping set is interrupted, the auxiliary oil pump will start up automatically. Its coming into operation is indicated on the switchboard. It is quite feasible occasionally to run both the motor-driven oil pump and the turbine-driven stand-by set in parallel. After the main pump set has been started up, the auxiliary set can be switched off by hand.



Rotor ready for inserting in the stator

After shutting down the machine set, automatic starting of the auxiliary oil pump set is prevented by the drum controller. The auxiliary set can also be started up by hand, independent of the automatic equipment.

Position 2 of the drum controller : If an oil pressure relay indicates that the guide vanes and the pressure regulator are closed, the automatic gear of the rotary valve is actuated by means of a motor-driven control valve and the rotary valve is opened. The "Open"-position of the valve is indicated on the switchboard.

Position 3 of the drum controller : The turbine is started up by opening the guide vanes. This can only be done if the oil pressure brake is not under pressure, i.e. if the brakes are not acting, which is ensured by means of auxiliary contacts on the brakes. The machine now runs up until a certain speed has been attained, which is somewhat lower than the synchronous speed, and which is limited by means of contacts on the speed adjustor. When this speed is attained, an indication is given on the switchboard.

Position 4 of the drum controller : The alternator is automatically run up to synchronous speed by means of a differential frequency regulating relay. As soon as the preliminary conditions for the synchronizing are fulfilled, the oil circuit-breaker is switched in by the synchronizing gear. The closing of the oil circuit-breaker is indicated on the switchboard.

Position 5 of the drum controller : The synchronizing apparatus is cut out and the speed adjustor for regulation by means of operating switch is released. With the aid of the remote controlled speed adjustor, the speed of the turbine can be increased until the automatic water-level indicating and regulating device cuts in. Further regulation of the turbine and, therefore, of the effective output of

(Continued on page 281)

New Siam Progresses*

UNDER the new revolutionary government which succeeded King Prajadhipok's absolutist regime, Siam is making excellent progress. The people are at peace and apparently reasonably contented.

Although Prajadhipok, who is now living quietly in England, is still popular among the masses in Siam, there is no openly expressed desire for his return. The new Constitutional Government seems to have met all the reasonable desires of the people.

It is a new, rejuvenated Siam, stronger, more democratic and independent than ever before, with a liberal Constitution on the European model, enacted in 1932.

The Premier, Col. Phya Phahol Pholphayuha Sena, with the Foreign Minister, Luang Pradit Manudham, and the defence Minister, Col. Luang Bipul Songgram, form a sort of benevolent Triumvirate trusted by the people. The Premier has repeatedly expressed his desire to retire from official life, but in every case the people have urged his retention of office.

The Government has balanced the budget. It has instituted numerous reforms in every department of the administration of this country of 16,000,000 persons.

One of the most salutary achievements has been the abolition of hundreds of Princes from Government posts. These royal relatives, often quite incompetent, held office only by reason of their noble birth, and constituted a drain on the State Treasury. They have now been replaced by educated Civil Service employes who receive modest salaries.

Having as its keystone the policy of friendship with all nations, the new government has concluded during the past year no less than 12 treaties with foreign powers. These treaties bind Siam with these powers, not only in peace, friendship and commerce, but abolish extraterritorial rights which some of these powers formerly exercised in Siam under the monarchy.

Full Sovereignty Recognized

Under the new treaties Siam's full sovereignty is recognized as well as her financial jurisdiction over all sources of internal revenue. The right of Siamese Courts to try civil and criminal cases involving foreigners also has been established. Siam's new treaty with the United States covering these points is now awaiting ratification by the United States Senate.

The heavy financial burdens of the people have been relieved by the introduction of co-operative farming societies, somewhat similar to those in India. The chief benefit conferred by these newly-established organizations in Siam rests in the emancipation of the small landowner from the clutches of usurious money-lenders, a condition which is prevalent throughout Siam's predominantly agricultural population.

Under the new system these co-operative societies assume the debts of their members, aid in marketing crops, and are permitted to borrow money at nominal rates of interest from state banks.

In view of the disturbed state of the Orient, the new Government in Siam has found it wise to strengthen its Army, Navy and Air Force, in order to be prepared against any possible invasion.

Military expenditures for the current year, however, represent only one fifth of the total national budget, while 11 per cent is devoted to education.

Among the various reforms introduced by the new Government in Siam which directly benefit the people, may be included universal education. Because of the high percentage of illiteracy prevailing under the Monarchy, universal suffrage for all Siamese men and women will automatically go into effect after the masses have had the benefits of 10 years of education under the new Constitutional regime. Schools, including those in rural districts, now requires the study of English or French, in addition of the native language. Hundreds of new schools are being built. School-teachers are being trained, and Siam may look forward to a new era of culture and education.

Jungle Areas Opened Up

Coincident with these improvements by the new Government, large areas of heretofore isolated jungle provinces are being opened up to modern trade by extensive roadbuilding. The Government's already excellent railway system is being expanded.

Widespread reforms and improvements have been introduced into the country's agriculture, sanitation, irrigation and medical service. Indeed, it may be said that Siam under the new Government, which is largely run by young men who received their education in the liberal institutions of the United States, England and France, has made more progress during the past few years than at any period during the past century.

This is the opinion of the majority of Americans and other foreign nationals residing in Siam. A remarkable feature of the sweeping changes made in this Asiatic Country by the new regime, is that they have been achieved with virtually no bloodshed and no disorder.

Popular impressions abroad notwithstanding, Japan exercises no more influence on Siam than any other nation. Here and there, especially in Bangkok, there are small Japanese retail shops and some artisans, but their number is small compared to the number of Chinese in the country. Only one Japanese expert is employed by the Government—in a minor post in the Cotton Experimentation Department—and he is about to return to Tokyo.

On the main street of Bangkok is a shop window bearing the words, "Japanese Trade Mission." Inside a half-dozen Japanese clerks pore over their work. This mission came to Bangkok some time ago when the chances of large trade seemed bright. But to-day, because of the rigid boycott of Japanese goods by the large Chinese population, Japan's business has slumped and Siamese predict the mission soon will close up shop.

* *Christian Science Monitor*

Mineral Deposits of the U.S.S.R.

(Continued from page 267)

limonite ore, 18.7 per cent. The mean iron content of all the grades over a series of years was 61.63 per cent made up from: Martite, 62.95 per cent Fe.; magnetite, 57.86 per cent; brown iron ore—clastic accumulations—57.91 per cent; red iron ore—hæmatite formed at the expense of chlorite schists—51.50 per cent.

In 1937 the Ordjonikidze mine was working two ore-bodies 200 meters and 340 meters long respectively, and from 25 meters to 40 meters thick, at a depth of 260 meters maximum, although the bodies are said to be proved at 1,000 meters. The grade of the ore was 60 per cent Fe. and the output 6,250 metric tons a day. The mining methods used were sub-level stoping and sub-level caving, the units being worked parallel to the dip or parallel to the strike according as the thickness was less than 25 meters or greater. A 7½-hour working day was in operation and the wages varied as follows: Average of all above and below, 300 to 375 R. per month (£1 at 26 R.); Stakhanovites from 900 to 1,240 per month; drillers from 660 to 750; muckers from 500 to 700; women trammers and loco drivers from 200 to 300.

The Schwartz mine was working a major ore-body, up to 250 meters long and 60 meters to 100 meters wide, together with smaller ore-bodies, 150 meters long and 8 meters to 10 meters wide. The grade of the ore averaged 59 per cent and was low in P. and Ti. – a magnetite ore-body. The output was of the order of 2,100 metric tons a day and the mining methods employed were mainly sub-level stoping, with levels 40 meters apart, which was gradually replacing shrinkage stoping in units 60 meters long by 40 meters high by 8 meters wide; pillars between each unit 5 meters. Glory-hole mining was also practised.

Hsinking's Rapid Development of Major Industries*

By KAZUE KIKUCHI, of the Investigation Section, Manchuria Electric Industry Co.

MANCHOUKUO controls all the important industries from the national standpoint with the result that there is little room for private interests insofar as the major key industries are concerned. In pursuance of the Government's principle of "one firm for one industry," there have been established 20 special companies and eight semi-special companies in various industries including finance, insurance, heavy industries, chemical industries, communications, railway, mining, metals, forestry, and colonization.

All of these firms, except only three, have been financed by the Hsinking Government from 30 to 50 per cent of their respective capitalizations. In May, 1937, the Major Industries Control Law was promulgated, subjecting some 21 industrial branches to rigid control of the Government.

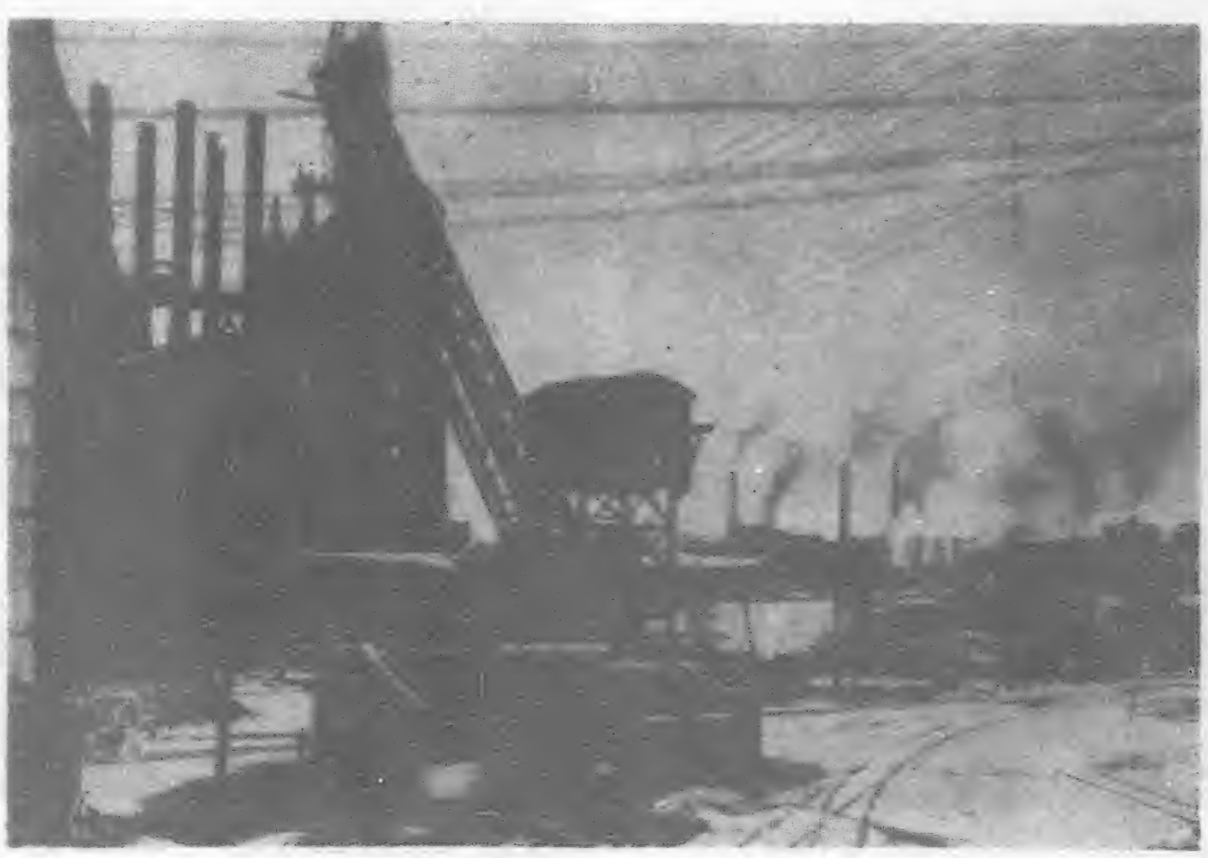
With the five-year industrial plan of the new State developing into a second stage and a new vista opened up for Japan's continental works in connection with the current Sino-Japanese hostilities, however, the authorities concerned have come to see their desk planning deadlocked everywhere and have been obliged to reconsider their dogmatic attitude in industrial administration. Thus was it that Manchoukuo has invited Mr. Yoshisuke Aikawa, head of the Nissan interests, to establish a gigantic holding company like the Manchuria Industrial Development Corporation.

Such a reform of the Manchoukuoan industrial policy, that is the engagement of the service of the talented Mr. Aikawa, will mark a milestone in development of the electric power and the electro-chemical industries, as well as various heavy industries. Raw materials for the chemical industry are plentiful in the new State, electric power can be generated sufficiently by both water and steam power, and there are many districts suitable for establishment of electro-chemical enterprises. Just as the chemical industry has made remarkable progress of late in North Korea, so will it make strides in Manchoukuo with the development of her five-year industrial plan.

Operating Ten Power Stations

The power supply industry in Manchoukuo is controlled by the Manchuria Electric Industry Company. The company is now operating ten power stations, one each at Dairen, Yinkow, Sian, Mutankiang, Antung, Hsinking, Harbin, Tsitsihar, Hokang and Chinhsien, all of which adopt steam power plants because of the cheap and ample supply of coal. Besides, there are three thermal power stations at Anshan, Fushun and Penghsihu, which are operated by and supply electric power to the Showa Steel Works, the Fushun Colliery and the Penghsihu Iron Works respectively. Their combined capacity is more than 520,000 kw. The addition of some minor power stations would boost the capacity to about 550,000 kw. Since the scientific investigation has revealed that Manchoukuo has comparatively larger water power resources than previously considered, a large scale scheme has been mapped out for active exploitation of water power as part of the five-year program.

The electro-chemical industry is still in the course of making in Manchoukuo. There are only two independent firms in this field, the Manchuria Chemical Industry Company and the Manchuria Soda Company. The former is planning to enlarge its ammonium sulphate capacity from 220,000 to 280,000 metric tons a year, and the latter will enlarge its soda capacity from 30,000 to 108,000 metric tons. Then there is the Fushun Colliery of the South Manchuria Railway Company operating a large scale oil shale plant, and it has an ambitious plan to produce 500,000 tons of heavy oil in the future.



Showa Steel Works, Anshan

Governmental Approval Given

The Showa Steel Works has an electro-chemical factory for utilization of its by-products. It is anticipated that the chemical industry will make marked progress in line with the development of the electric power supply industry. Actually, Government permission has been granted to the following companies tabulated below with their annual capacities in 1,000 metric tons for their respective products and locations:

Industry	*Company*	*Location (province or town)*	*Capacity First plan*	*Capacity Ultimate plan*
PULP INDUSTRY:				
	East Manchuria Rayon Pulp Co.	Chientao	15	
	Manchuria Pulp Co.	Kutankiang	15	
	Japan-Manchou Pulp Co.	Kirin	15	
	Oriental Pulp Co.	Chientao	15	
	Manchuria Bean Stalk Pulp Co.	Fengtien	18	
ARTIFICIAL OIL INDUSTRY:				
	Manchuria Liquefaction Industry Co.	Ssupingkai	50	250
	Manchuria Synthetic Fuel Co.	Chinhsien	30	300
	Fushun Coal Liquefaction Factory	Fushun	20	360
ALCOHOL INDUSTRY:				
	Tatung Alcohol Co.	Pinkiang	6	30
ALUMINIUM INDUSTRY:				
	Manchuria Light Metal Engineering Co.	Fushun	4	12 (Aluminium)

(Besides, there are eight cement factories with the total capacity of 1,500,000 metric tons a year).

Besides, many new projects are being worked out, although on many of them there has been no deliberate planning. In order to promote the coal liquefaction industry in the Kirin district, for instance, two exclusive firms are proposed at Shulan and Holung with capacities of 100,000 and 50,000 metric tons a year respectively. Another oil shale company is to be established at Lotzukow with capacity of 300,000 metric tons of heavy oil a year. Alcohol industry will be promoted at Antung and Mutakiang.

There are several schemes for the aluminium industry. It is expected that alumina plants will be set up at Fushun, Antung and Dairen, and that an aluminium refinery will be built at Antung. Attempts are being made to establish magnesium refineries at Antung and Yingkow. Because of the ample supply of limestone in the vicinity, Dairen and Kirin will see the establishment of the carbide industry and allied enterprises. A large ammonium sulphate factory is to be constructed at Kirin. Soda factories are scheduled for Fengtien, Kaiyuan and Tumen.

In anticipation that these projected electro-chemical plants will require an enormous amount of electricity, the Manchuria Electric Industry Company and other interests concerned are pushing their plans to boost the power output. The existing thermal power plants above referred to will be expanded to the total capacity of 870,000 kw. in some years to come. Besides,

*Translated from the *Toyo Keizai Shimpo*, by *Contemporary Opinions*.

three large water power stations are now under construction along the Second Sungari, the Yalu River and the Pingpo Lake with capacities of 180,000 kw., 630,000 kw. (of which 320,000 kw. is allotted for Manchoukuo), and 75,000 kw. respectively. Their total capacity will be 575,000 kw. The combined capacity of these water and steam power stations, all of which will be completed by 1940-42, would amount to 1,445,000 kw. According to the recent investigation of experts in this field, there is a great amount of untapped water power resources which can be exploited in the future. These include 124,400 kw. near Huanjen in the Eastern Frontier District, 133,000 kw. along the Yalu, 133,000 kw. along the Second Sungari, 60,000 kw. along the Tumen, 350,000 kw. along the Luanho, and 200,000 kw. along the Nonkiang.

Promising Industrial Centers

What is more encouraging is that there are in Manchoukuo many districts suitable for electro-chemical enterprises where electric power is easily available, where supply of raw materials is abundant, and where labor is cheap and transportation facilities are well developed. Such promising industrial centers include Kirin, Mutankiang, Antung, Fuhsin, Chinhsien, Dairen, Fushun, Fengtien, Anshan, the Eastern Frontier District, Yingkow, Ssupingkai, Lotzukow, and others.

The Kirin district, being situated in the center of Manchoukuo, has well developed communications not only with the other cities such as Hsinking, Harbin, Ssupingkai and Fengtien but also with North Korean port cities such as Rashin and Seishin. Electric power will be supplied cheaply and amply from the power stations in the Sungari valley above referred to. There is a limestone deposit of 150,000,000 metric tons and a coal deposit of 1,000,000,000 metric tons in the neighborhood.

Industrial chemicals, necessary for modern industrial enterprises can easily be supplied from Korea and Japan through the Hsinking-Tumen Railway. Labor is cheap and plentiful. Excepting the existing industrial centers such as Anshan, Fushun and Fengtien, this part of Manchoukuo may be considered the most promising district for electro-chemical establishments. It is reported that the Hsinking Government is now making a comprehensive study for establishing carbide, calcium cyanamide, ammonium sulphate, dyestuff, synthetic rubber, and acetate rayon industries.

Antung, a port city at the estuary of the Yalu which has been nothing but a small commercial town, is destined to become an important industrial center. Electric power will be supplied there from the power stations on the Yalu. Raw materials will come from the Eastern Frontier District. The city is a center of communications both on land and sea. Along the Fengtien-Antung Railway there are many ore deposits : namely, 500,000,000 metric tons of limestone, 3,000,000 tons of pyrites, about 100,000,000 tons of alum shale, and 5,000,000,000 tons of magnesite. And not to speak of dense forests on the upper reaches of the Yalu. Such being the case, alcohol, light metal, and cellulose enterprises will prosper there.

Importance of Fuhsin Mine

The Fuhsin coal mine, with an estimated deposit of 5,000 million metric tons, is one of the most important coal fields in Manchoukuo. Including Chinhsien and Hulutao (a port), this district is equipped with all the necessary conditions for development of the electro-chemical industry. Now under construction there is a large thermal power station. The Manchuria Fuel Company, the Manchuria Salt Industry Company, the Manchuria Soda Company and other interests have decided or are planning to operate their respective plants in this area. And the Manchuria Lead Mining Company is pushing its plan for exploitation of lead ores at Yangchiatzu.

With the promotion of development works in North China in connection with the current Sino-Japanese hostilities, Dairen will add to its importance not only as a commercial port but as an industrial city as well. Apart from the machinery, metal and shipbuilding industries already undertaken in this port, the carbide, aluminium and soda industries will most likely be established there, for there is available in its vicinity a large amount of limestone (deposits being estimated at 700,000,000 tons), alum shale (deposits at 10,000,000 tons), and industrial salt.

In the Fushun-Fengtien-Anshan district, as everybody knows, are a number of modern industrial enterprises prospering. And this area, including Penghsihu, is and will be the most important industrial center of Manchoukuo. Aluminium, shale oil, and coal liquefaction enterprises will be promoted there more than ever.

Mutakiang is the only place which has bright prospects as an industrial city in North Manchuria, but detailed explanation is not made in this short survey.

Heavy Coal Deposits

The Eastern Frontier District has recently been found to be an invaluable treasure-house of Manchoukuo. Coal deposits there are estimated at 120,000,000 metric tons, of which from 2,000,000 to 2,500,000 tons can be exploited annually ; iron ore deposits, at 50,000,000 tons ; and forest resources, at 300,000,000 koku (one koku corresponding to about ten cubic feet). Besides, limestone is said to be inexhaustible, and other ores such as magnesium, manganese and lead are not scarce. Although the transportation facilities are quite undeveloped at present, the South Manchuria Railway Company is planning two railway lines, the one extending from Maihokow through Tunghua to Chian, a city on the Yalu, and the other from Tunghua through Huanjen and Kuantien to Antung. Upon completion of these two lines, for which construction works have already been started, Chian and Huanjen, among other cities, will become active industrial centers. Chian, it is reported, will be connected by railway service with Heijo in Korea.

In the Yingkow district to which electric power will be supplied from the Fuhsin station mentioned in the foregoing, magnesium and soda enterprises will be undertaken. For salt is available abundantly along the near-by coast, and magnesite is plentiful at Tashihchiao.

Modern tractors used on Japanese immigrant farms

The world-famous Fushun open-cut mine, with a mountain of coal in the background

New Canals in the U.S.S.R.

By LOUIS SEGAL, M.A., Ph.D. (ECON.), DR. PHIL in the Dock and Harbor Authority

CONSIDERABLE attention has been devoted in the U.S.S.R. in the last few years to the improvement of the internal waterways. Of all the undertakings for the development of the internal waterway system carried out in the period of the first Five-Year Plan (1928-32), the White Sea-Baltic Canal was the most important.

The White Sea-Baltic Canal

It was in 1931 that the Soviet Government decided that a canal was to be excavated so that ships could sail from the White Sea to the Baltic without going all the way round by the North Cape, down the coast of Norway and through the Skager Rak and the Kattegat.

This was an old project. The first scheme dated back to the eigtheenth century. It was proposed by a Russian merchant named Bakinin, supported by an Englishman—Adam Strong—and others, but nothing came of it. The Tsar's Government sent a General, an engineer by training, to report. The General did not like the idea—there were too many waterfalls and rocks, he believed.

From that time till the Great War, numerous schemes for the building of a canal were proposed, but without result. Under the last Tsar it was decreed that a railway in Karelia was to be built and the project of a canal to be abandoned.

But in 1931 new rulers were at the helm in the U.S.S.R., and they decided that there should be a canal and that it should be built within two years. The building of the canal was to form part of a vast scheme for the improvement of the internal waterways of the country. The whole scheme included the White Sea-Baltic Canal, 227 kilometers long; the Moscow-Volga Canal, 128 kilometers long; the Volga-Don Canal, 100 kilometers long; the reconstruction of the Mariinsk and Moscow River water systems; and the making of the River Dnepr navigable along its whole course.

A serious problem faced the Soviet Government in the attempt at realization of the ambitious plan of the first canal. The demands of the new enterprises under the first Five-Year Plan were so huge that there were hardly enough men to do the work. There was a particular shortage of skilled labor and no one could be spared. On the other hand, there were thousands of men and women who had been sent to labor camps for periods varying from two to ten years, and the problem in connection with them was what was to happen to them during their detention and afterwards. It was then proposed that the construction of the White Sea-Baltic Canal should be entrusted to those undergoing sentence.

The aim behind the construction of the canal was much more than an improved and safe route for shipping. In the first place, the canal was to develop Karelia itself, an area greater than Central Europe. The long night of the Polar Region was to be lighted by electricity produced by hydro-electric stations built in connection with the canal. The vast mineral resources of the area were to be mined, new cities and towns built, swamps drained, and factories erected. Karelia has deposits of copper and iron, and at Lake Vygo, even gold. Karelian granite is an excellent material for building proposes. Up to that time this enormous wealth remained not only unused, but even unexplored.

Hub of Ambitious Scheme

The construction of the canal also formed the central part of a very ambitious scheme for the development of Arctic navigation. A new port for ocean-going vessels was to be built at Soroka, the northern extremity of the canal. Breakwaters had to be erected so that large ships could anchor within their shelter. At the southern end of the canal—at Svir, below the rapids—a new hydro-electric station was to be built.

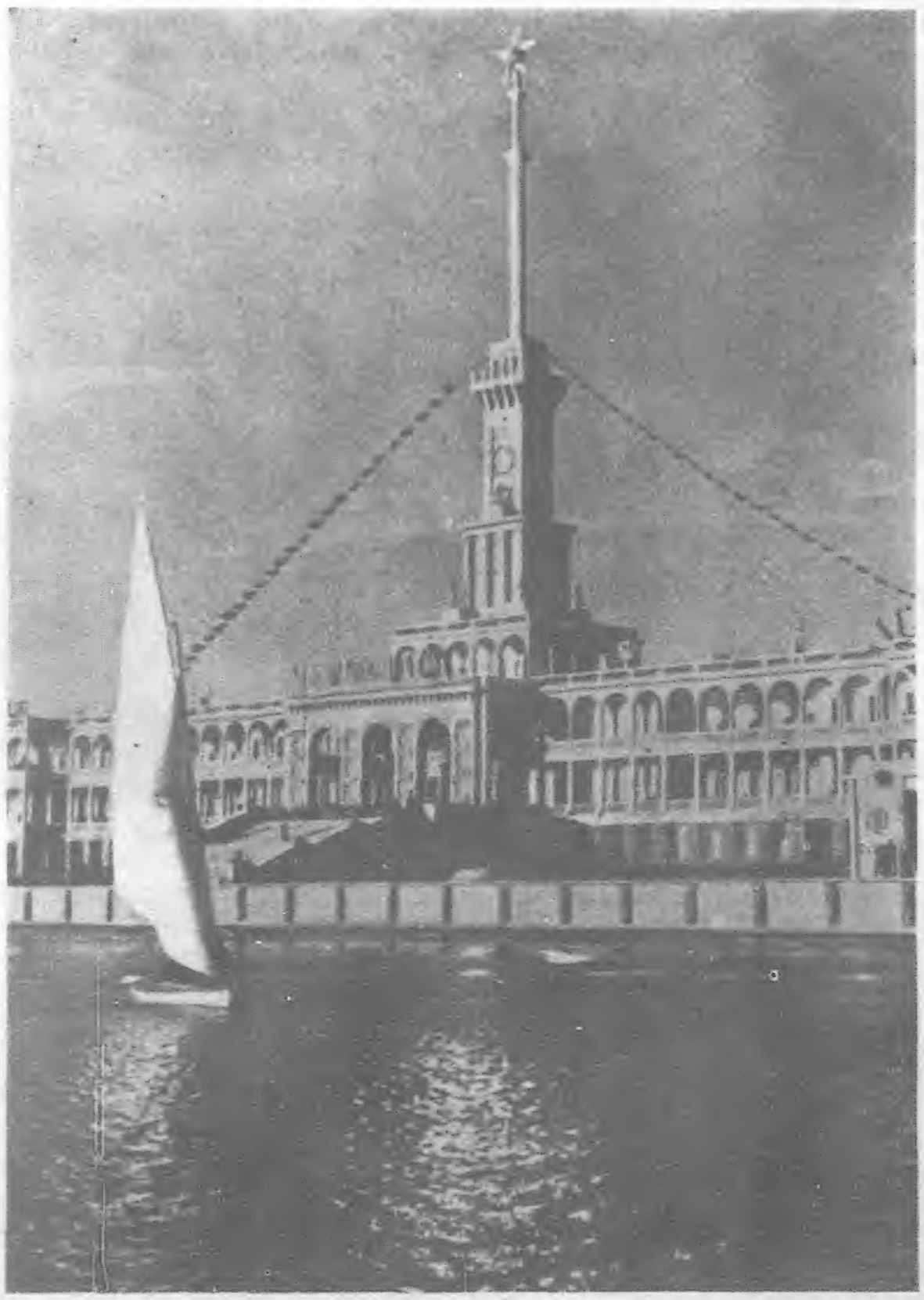
The Murmansk railway was to be electrified. A hydro-electric station was built for this purpose on the Tuloma River, and an auxiliary station on the Lake Not. Five hydro-electric stations for the southern section of the railway were built on the sluices and dams of the White Sea-Baltic Canal, where the River Vigo and Lake Vol roar over the 10-meter high weir.

The canal itself is one of the outstanding engineering feats of the century. The decision to construct it was taken by the Council for Labor and Defence in 1931, and the canal was officially opened to navigation on June 30, 1933. Thus only about three years elapsed between the decision to construct, and the completion of the huge project.

The canal connects the White Sea and the Baltic by providing a sea level waterway from Soroka on the White Sea to Leningrad on the Gulf of Finland. It reduces the water route between the Baltic and White Sea ports by 2,200 miles.

The whole work was carried out entirely by Russian engineers without any assistance from foreign countries. The stretch of 166 miles from the northern end of Lake Onega to Soroka was excavated by hand in twenty-one months. Through bitterly cold weather and torrid heat they pushed their task to successful completion, in record time.

It is of interest to note that the Panama Canal, which is only 81.3 kilometers long, and the Suez Canal, which is 164 kilometers long, took decades to construct, while this canal, which is 227 kilometers long, was constructed in twenty-one months. We can judge the scale of constructional work involved from the fact that it required the erection of more than one hundred structures, including nineteen sluices, fifteen dams, forty dykes, eleven locks and thirty-two inner canals. More than 200,000 acres of forest

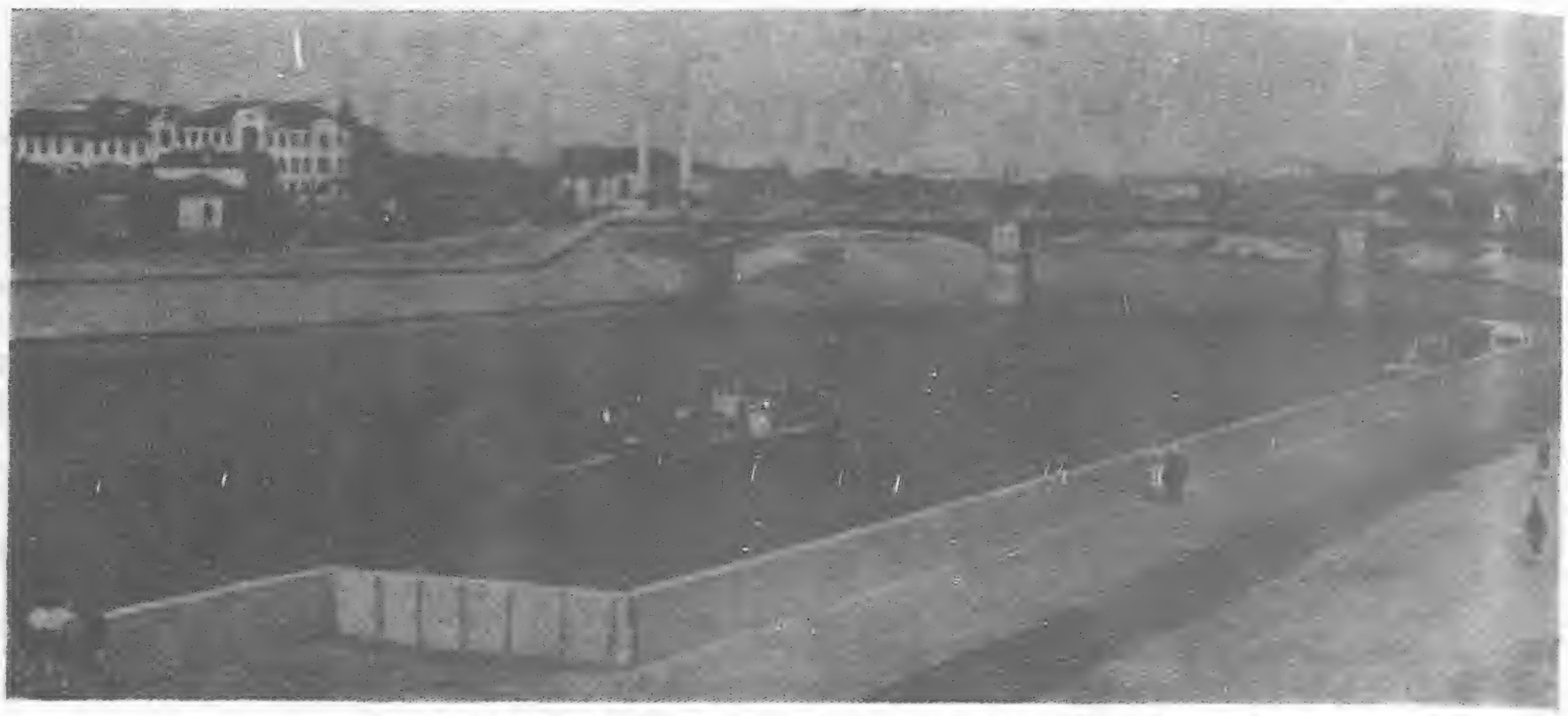


Khimki Passenger Station on the Moscow-Volga Canal

land had to be cleared before the work could be completed.

Before the construction of the Canal the only sea routes from the White Sea to the Baltic was around Scandinavian countries, and it took at least seventeen days. This journey has now been reduced by more than ten days.

The creation of new cheap and adequate facilities for the transportation of timber, grain, ores, oil products and building materials from the north by the construction of the canal, is of immense advantage to the whole country. An invaluable link has been created between the northern part of the country and the industrial centers. This was all the more important considering that the southern mouth of the canal at Leningrad is connected with the entire railway system of the country. The great economic advantage of the canal for the whole country is thus manifest.



The New Embankment on the Moscow River

The Moscow-Volga Canal

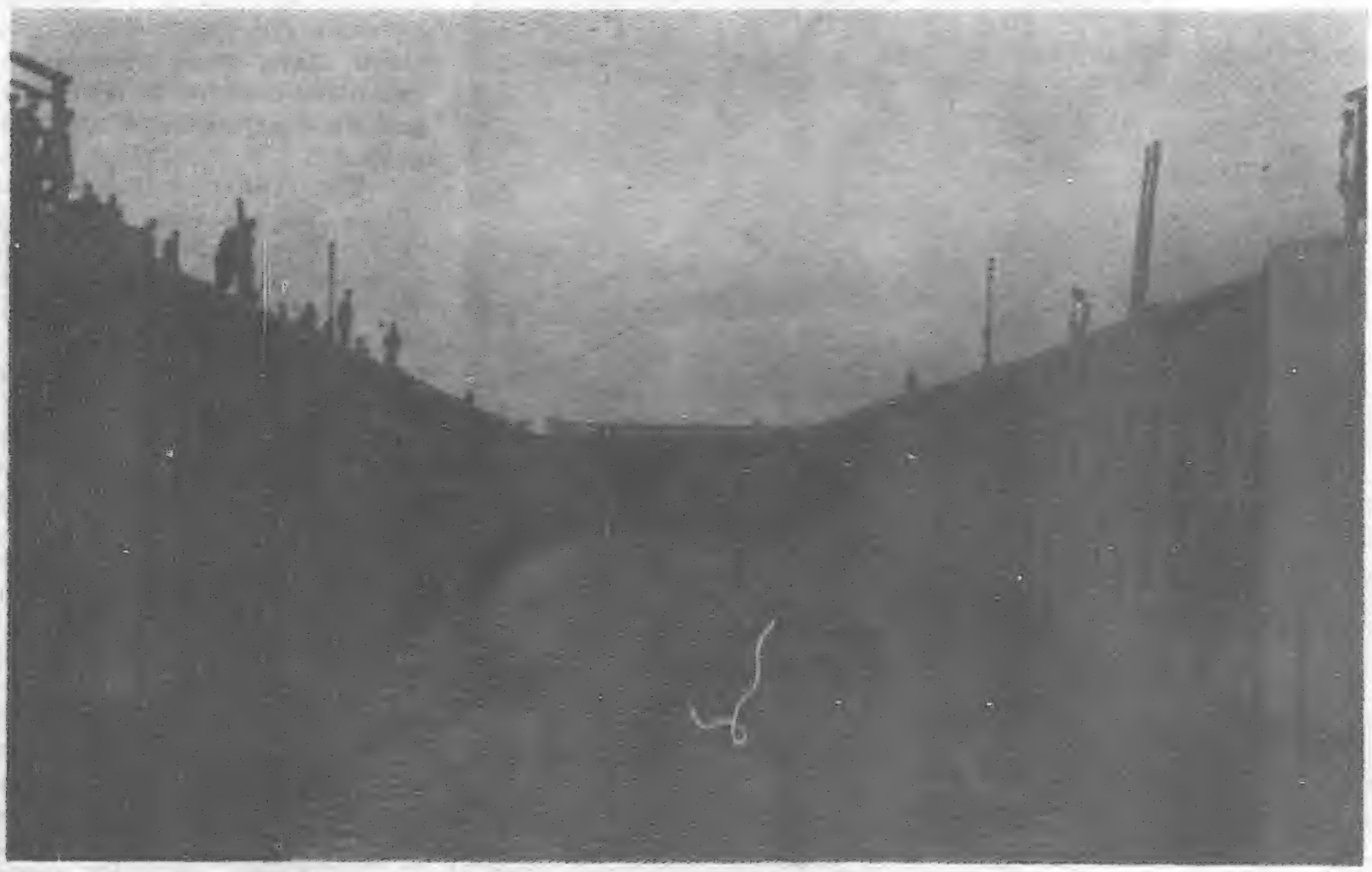
This canal begins on the Volga, at the village of Ivankovo, which has itself been transferred a distance of sixteen miles from its original site. Here an enormous dam was thrown across the river to form a reservoir 75 miles long, more than six miles wide in places, and 54-ft. deep. The power of the waterfall is utilized for the production of cheap electric power. Around the reservoir, called the "Moscow Sea," parks have been laid out, and fine houses built for administrative purposes, and for housing the workers and employees. Through Dmitrov, Ishka, Pushkino and Khlebnikov, the canal flows along an artificial bed to Shchukino village on the Moscow River. Along its length a number of dams have been built to form large reservoirs containing the water for the locks.

One of the Locks on the Moscow-Volga Canal

This feat of organization and engineering represented the second step in the plan for the complete reconstruction of the chief waterways of the U.S.S.R. Its construction was a great triumph of Soviet hydro-technical engineering, and demonstrated the feasibility of the project for a system of deep inland waterways designed to strengthen the political, economic and defensive power of the country.

The value of the Moscow-Volga Canal for the capital and its effect on the whole water transport system is immeasureable. It creates a deep-water route from Moscow to the Volga, shortening the water distance between Moscow and Leningrad by 1,100 k.m.; deepens the Moscow River for the passage of large Volga steamers, assures the city of an ample supply of drinking water, and through this canal the capital of the U.S.S.R. will eventually become a port of five seas for it connects Moscow with the White, Baltic, and Caspian Seas, and after the construction of the Volga-Don Canal the capital will also be connected with the Azov and Black Seas.

The water route between Moscow and Kalinin has been shortened by 1,728 kilometers. After the completion of the dams at Uglich and Rybinsk, which are at present under construction, the canal will connect Moscow by the shortest cut with the lower Volga and reduce the distance between the capital and Gorky (Nizhni-Novgorod) by 110 kilometers.



Lock on the Baltic-White Sea Canal

There have been many attempts—some dating as far back as the 17th century—to connect the Moscow and Volga Rivers so as to establish waterways that would give a direct outlet to the Baltic and the Caspian from the center; however, nothing came of all these attempts. The Soviets have succeeded where Tsarism failed, and on a scale which is a triumph for Soviet industrialization. For size, the Moscow-Volga Canal can be compared only with the Panama Canal and the Suez Canal. The actual commission to build the Moscow-Volga Canal, which is 128 kilometers long, was received by the People's Commissariat for Home Affairs, at the end of 1932, and the construction was completed and declared ready for navigation on July 15, 1937, the whole of the work having been completed in less than five years.

Speed in Construction

The rate at which the canal was constructed is perhaps one of its most amazing features, for the work comprised 200 million meters of excavation, three million cm. of concrete, 450,000 cm. of reinforced concrete structures, and the materials used included 870,000 tons of cement, more than a million cm. of stone, 170,000 tons of iron, 180,000 carloads of rock and gravel. The builders laid 125 km. of permanent railway, 375 km. of temporary wide gauge and 274 km. of narrow gauge track, 690 km. of highways. They used 160 locomotives, 2,100 flat trucks. 225 narrow gauge engines, more than 3,000 motor lorries, 171 excavators, and a vast quantity of other equipment. Large areas of moorland had to be converted into hilly spaces. Powerful water pumps had to be installed to force the Volga water into a new direction—to the south. The whole town of Dmitrov had to be cut in half by the canal, and a large bridge erected joining the two parts. A number of villages with a total of four thousand peasant households and the old town of Korchev had to be transferred from an area that is now inundated.

Work on the canal proceeded night and day in three shifts. Many of those engaged on it were people undergoing sentences. Numbers of these unskilled men not only reformed their characters in useful work, but acquired new qualifications which enabled them to become useful members of society.

In addition to the wharves that have been built, two harbors are under construction—a northern harbor near Khimki with a passenger station, and a southern harbor near Pererva. The northern harbor will be used for unloading cargoes, which come by the Moscow-Volga Canal, while the southern harbor will be mainly used for goods coming to the Oka and Moscow Rivers.

Mechanically-equipped wharves are being constructed near the village of Fili, while the construction of another harbor is planned near the Ismailova village.

The control towers of all the ten sluices are symmetrically placed along both sides of the canal. They resemble large portals through which the steamers pass. Almost all the towers are decorated with sculptures.

At the entrance to the canal from the "Moscow Sea" huge granite statues of Lenin and Stalin have been erected, while along the stone-paved canal embankments are placed statues of women, builders and sportsmen. The towers of the third sluice are faced with white stone, and resemble huge pedestals. On them are erected brass models of the caravels of Columbus, executed with great skill.

The river station near Moscow is surrounded on one side by a park, and on the other by a water reservoir, the surface of which reflects the building with its lofty tower and a spire 27 meters high.

Architecture Pleasing

In the front of the station is a colonnade, horseshoe-shaped, made of granite and faced with marble. The building itself resembles a steamer. Its inner rooms are richly decorated with paintings, mosaics, marble and bronze.

The architecture of the canal locks and dams, its power stations and bridges is pleasing to the eye. The whole huge construction must be regarded as a masterpiece of skilful blending of architectural arrangement, sculpture and engineering with the natural surrounding landscape and vegetation. The speed and efficiency with which

(*Continued on page 278*)

Japan's Iron and Steel Industry*

NINETEEN thirty-seven was a year of transition for the iron and steel industry of Japan, a year in which it left its relatively minor position in an economy dominated by the light industries and assumed leadership in the quickened movement toward a more balanced industrial set-up.

The iron and steel industry led too in another direction. It was first to be placed under full Government control. A near famine of basic metal at the beginning of 1937, coinciding with the increasing demands of the munitions industry and the growing difficulty of obtaining materials abroad, brought promulgation of the Iron Manufacturing Industry Control Law many weeks before the China incident began.

Additional measures were adopted after the incident got under way. As a result, the industry entered 1938 with most of the control organizations experienced and functioning more smoothly than some of the newer boards and bureaus.

All iron companies, almost in unison, drafted schemes for expanding production to the limit. Capitalizations were raised as the Government encouraged the industry to draw on the nation's stock of investible funds.

Figures on iron imports and production have become national secrets. Nevertheless, the rise in investments in the industry and the wide gain in imports listed in the Government's foreign trade report as "other metals and ores" are positive indications that a phenomenal growth is in progress.

Improve Position

Japan will come out of the present stringent period with a greatly enlarged plant and many more trained metal workers. The nation will have gone a long way toward shifting the center of industrial gravity from the light industries to the heavy.

Until the appearance of heavy military orders after the Manchurian incident, the industry kept almost abreast of the domestic demand. When in the future the munitions demand slackens, the industry will be able to turn out a sizeable excess above home consumption. To avoid going into a severe depression, it must find an export market. Whether the industrialization of Manchoukuo (the new state also will be a strong competitor in this field) and North China will furnish that market remains an open question. Whether the industry will be insured of adequate supplies of ore from controlled areas is equally undeterminable now. Japan is laying heavy odds that the answers to those questions will be in the affirmative.

In the meantime, the nation is plunging headlong into the trying task of throwing together enough plant to turn out iron and steel to meet the enormous demands of a military campaign.

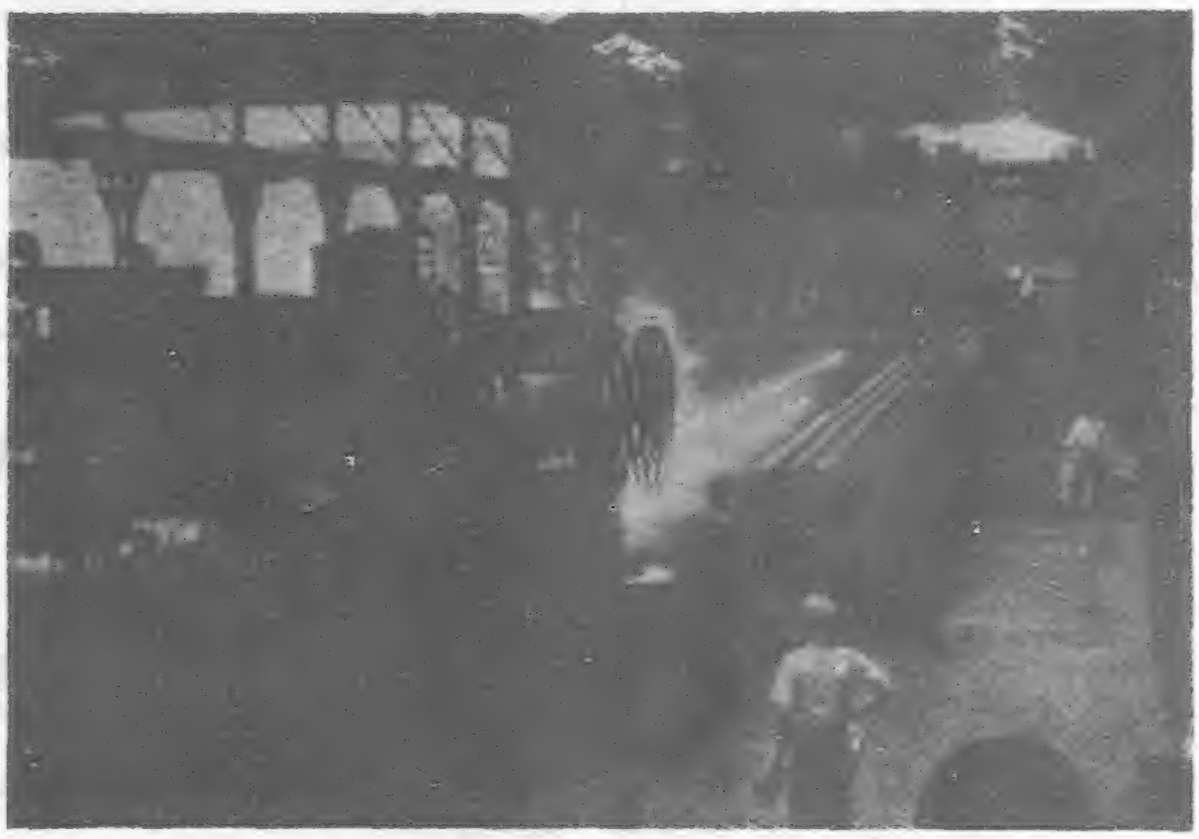
Ore Problem Remains

But the problem of ore supply remains. The domestic supply has never been nearly adequate. And in recent years the demand has far outdistanced the home output despite a remarkable increase. As short a time ago as 1931, the domestic production of iron ore was 208,000 metric tons. By 1935 it had been raised to 515,000 metric tons. In 1936, it was hiked to 797,000 metric tons. Most of the latter gain was made possible by new processes for extracting the metal from iron sand and lowgrades.

While the gain in 1937 and the first half of 1938 is not known, the great stir made by the Government, with inducements finally giving way to direct orders, cannot have failed to add many thousands of tons to the output.

Operations in Japan proper are against a background of reserves estimated at 80,000,000 tons. As late as 1935, economic development of these reserves was confined to Kamaishi, Kutchan and a few other mines. It is understood that subsidies are bringing back into production a number of marginal mines. In addition, there are several hundred million tons of iron sand, which was worked in ancient times but was not tapped in modern times, due to lack of an economical extraction method, until a start was made with a new process in 1934. Less than two years ago, the Nippon Iron Sand Engineering Company was successfully treating 20 tons of 30 per cent sand daily at its Takasago refinery in Hyogo Prefecture. The comparatively abundant iron sand undoubtedly has been resorted to on a much larger scale, whatever the cost margin.

Korea is a much more fertile source of iron ore than Japan proper. When in 1929 Japan produced 178,000 metric tons, Korea yielded 559,000 metric tons. In 1933, the ratio was 321,000 for Japan and 523,000 for Korea. A year later, it was 432,000 and 571,000. In 1936, imports from the colonies together were 650,000 metric tons. Korea is estimated to have low-grade iron ore deposits of about 5,000,000 tons of 50 per cent quality, 100,000,000 tons of above 40 per cent quality and 300,000,000 tons of above 30 per cent.



A working view in the plant of the Japan Steel Tube Company at Kawasaki (near Yokohama), one of the centers of heavy industry

New Processes Important

However, domestic and colonial supplies of ore have been far short of the demand. The amount furnished by Japan and its colonies amounted to 19.9 per cent of the total consumption in 1931, to 18.2 per cent in 1935, and to 27.4 per cent in 1936. The importance of the new processes is apparent from the share of the increase occupied by sulphuric acid slugs in 1936. In that year the new product was 21 per cent of the domestic output.

Japan's iron and steel industry was given its start in 1901 with the establishment of the Yawata foundry by the Government. Before 1913, production was relatively low. Stimulus of the World War led the industry into expansion, but it was in a depression for several years before the Manchurian incident brought a demand which, growing every year, has culminated in the overwhelming requirements of 1937 and 1938.

Consumption of iron ore rose 173 per cent in the five years from 1931 to 1936. In that period, imports from foreign countries (including Manchoukuo) climbed 147 per cent.

The magnitude of imports in relation to domestic and colonial production and to total supply is graphically depicted in the following table:

SUPPLY OF IRON ORE

(*In 1,000 metric tons*)

Year	*Domestic Production*	*Imports From Colonies*	*Imports*	*Supply Total*
1931	208	176	1,549	1,934
1932	226	151	1,482	1,860
1933	320	255	1,523	2,099
1934	431	180	2,131	2,744
1935	515	242	3,404	4,162
1936	†797	650	3,828	5,275

*From the *Japan Advertiser Annual Review.*

†Consists of 577,000 metric tons of iron ore proper and 220,000 metric tons of sulphuric acid slugs.

(Ratio of increases ; 1931=100)

Year	*Domestic Production*	*Imports From Colonies*	*Imports*	*Supply Total*
1932	108.6	85.8	95.6	96.6
1933	153.8	144.9	98.4	118.7
1934	207.2	102.2	137.5	141.1
1935	255.3	137.5	219.6	215.6
1936	383.1	346.9	247.0	273.3

It will be noted that the advance of imports has been especially rapid since 1933. These ores have come mostly from the Yangtze Valley in China, from North China, from the Malay Peninsula, from Yampi Sound Island in Australia and the Philippines.

Supplies from the Yangtze Valley mines were shut off at the beginning of the China incident. In May, 1938, the mines near Hankow remained outside the Japanese lines ; and those near Wuhu, although in occupied territory, were of little use in meeting the immediate demand as, according to Japanese newspaper reports, they were seriously damaged by the Chinese before their capture.

Also in May, the Australian Government considered making a survey of its ore resources and domestic needs to determine whether it should forbid further exportation.

Delay Seen in North China

Many Japanese reports from North China were distinctly not encouraging about a healthy increase in ore production without considerable investment and the building of more railways. Money aside, any large development would throw the production far enough into the future to be of little use in meeting the now pressing demand. Late in 1937, shipment of 600 tons daily from the famous Lungyen mine in North China was scheduled and started, with the ore going to the Yawata foundry, Kyushu. There were no public indications as 1938 progressed as to whether the schedule was being maintained.

Other Oriental sources also are being tapped with vigor. New Caledonia especially has been the object of development. Supplies have been sought too in Siam, French Indo-China, Sumatra, the Dutch East Indies and the Celebes.

A new five-year iron and steel plan embracing Japan, Manchoukuo and North China was formulated early in 1938 to supplant the five-year production increase plan started in 1936. The revisions were made by the Ministry of Commerce and Industry, the Cabinet Manchurian Affairs Bureau and the Cabinet Planning Board, according to the *Domei News Agency* and Japanese newspapers, which added that success of the plan apparently depended upon imports of about 9,500,000 tons from the South Seas, British India and Central China by 1940. Development of the Mozan Mine in North Korea to get 2,500,000 tons more by 1940 also was counted on. If *Domei's* estimate is correct, it follows that success of the plan depends upon easy access to and repair of the Yangtze Valley mines.

Cradled by Government

As indicated above, the iron and steel industry was cradled and nurtured by the Government. Before the World War, the Government's Yawata Iron and Steel Works was the principal producer. Private enterprises were on a small scale. At that time, the total annual production of pig iron was about 240,000 tons and the output of steel was about 255,000 tons.

By 1918, several new private companies had been established and all had grown. The 1918 production, including Korea, reached 630,000 tons of pig iron and 540,000 tons of steel. When the World War ended, a need for centralized control was seen and cartels for both production and sales were set up in 1925.

Despite a price decline in the years following 1918, production gained, amounting in 1929 to 1,240,000 tons of pig iron and 2,000,000 tons of steel.

Impetus of the demand of the military after 1931 sent pig iron and steel production to 1,940,000 and 3,340,000 tons, respectively, in 1934. In that year the position of the industry was consolidated by formation of the Japan Iron Manufacturing Company. The new firm was joined by the Yawata Iron and Steel Works and six leading private concerns. It was capitalized at Y.359,821,000 of which the Government invested Y.284,195,000. This giant concern dominated the industry, producing in 1934 about 96 per cent of the domestic output of pig iron, 53 per cent of the raw steel and 44 per cent of the finished steel.

In 1936, the domestic production of pig iron was 2,045,000 tons, and the output of steel was 5,258,119 tons.

1937 Output Gains

Production of pig iron by the major iron works in Japan proper and Korea in the first half of 1937 aggregated 1,276,696 metric tons, increasing 18 per cent over the output for the corresponding period of 1936, when the total was 1,074,505 metric tons. Pig iron production in Manchoukuo in the first half of 1937 amounted to 335,606 metric tons, advancing 4 per cent over the 1936 first-half output.

Domestic output of ordinary steel materials in the first half of 1937 amounted to 2,458,022 metric tons, which was a 22 per cent gain over the 2,044,412 metric tons of the first half of 1936.

In addition to the pig iron produced at home in 1936, Japan obtained from the colonies 113,776 tons and from Manchoukuo 271,224 tons. It imported 700,744 tons from other sources in 1936. Scrap and old iron imports (later figures on these imports also are unavailable) amounted to 1,497,043 tons.

Of the 3,130,744 tons of pig iron consumed by this country in 1936, about 70 per cent was produced domestically as compared with an average of 65.5 per cent for the years 1930 to 1935 inclusive and 59.9 per cent for the years 1920 to 1929 inclusive.

Although a rough estimate of the imports of ore, pig and scrap during 1937 might be worked out, there could be no assurance of its accuracy in view of the possibility of shifts in the various proportions. Suffice it to say on that score that imports of "ores and metals" in 1937 gained 140 per cent by value over 1936. Returns of the Finance Ministry as published by the *Oriental Economist* show the 1937 imports under that heading to have been Y.901,130,000 as compared with Y.374,891,000 in the previous year.

The five-year production program, as revised in 1938, calls for a pig-iron output of 12,500,000 metric tons in Japan, Manchoukuo and North China by 1940 and a steel production of 11,000,000 metric tons in the same year. Based on 1936, this scheme demands that the pig-iron production be increased 500 per cent in five years ; and steel production, a little more than 100 per cent.

Whether such an ambitious goal will be attained in its entirety depends upon a number of developments which cannot now be forecast. Inasmuch as considerable progress already has been made in raising the output of both products, it appears that the industry's production facilities will certainly be greatly enhanced under the stimulus of the Government-encouraged five-year program.

The 1938 iron production plan calls for completion of smelters by August to raise the iron capacity by 280,000 tons, the *Tokyo Asahi Shimbun* reports. Included are a 350-ton smelter at the Tsurumi Iron Works, a 1,000-ton smelter at the Yawata foundry, a 700-ton smelter at Kamaishi and one or two smelters at the Anshan plant of the Showa Iron Works.

"Monopoly" Complaints Obviated

Japan Steel Tubing ignited its No. 3 blast furnace in May, raising that company's daily output of pig iron by 600 tons to a total of 1,400 tons. Japan Iron Manufacturing announced early in 1938 that it had decided to install two 1,000-ton blast furnaces at its new foundry at Hirohata instead of three 700-ton furnaces. The change will speed up construction, which now is thought likely to be completed by 1940.

Mitsubishi Mining Company reportedly has obtained a Krupp patent on a process which will be initiated in August, 1938, in its new plant near its famous Mozan mine, in Korea.

Before 1937, there was some complaint about the difficulty private companies had in obtaining permission to install blast furnaces. The complainants felt that the Government's company, with 96 per cent of the production, was maintaining a monopoly. With the advent of the five-year plan, this difficulty disappeared. Leading concerns which did not have blast furnaces in the past, began erecting them. Among them were Kokura Steel, Nakayama Steel and Amagasaki Steel.

Permits were issued in November, 1937, by the Ministry of Commerce and Industry to eight companies to install electric furnaces. The companies were Japan Iron, Fujietsu Steel Industry, Japan Metal Industry, Komatsu Refining Industry, Japan Cast

Iron, Hitachi Works, Automobile and Cast Iron and Japan Electric Development.

The Ministry issued permits on March 30, 1938, for erection of electric furnaces by these companies: Tokuyama Iron Plate, Japan Galvanized Iron Industrial, Tokyo Hoop Manufacturing, Japan Sand Iron Industrial, Tohoku Development Chemical, Miyazaki Steel, Riken Steel Materials, Osaka Iron and Japan Iron.

Refusal Indicated

On June 7, 1938, similar permits for 12 projects were issued. However, the Government appeared to be cautious in granting the licenses because of the limited supplies of raw materials. Under the circumstances, applications for further licenses are likely to be held up, with indications that they may be refused.

In May, 1938, the Japan Iron Manufacturing Company was casting about for Y.300,000,000 to finance its share of the production increase scheme. It proposed first to issue Y.100,000,000 worth of debentures, and negotiations with bankers were under way. It intended to get Y.152,252,000 more by raising its capitalization to Y.511,073,000. The capital increase proposal was sanctioned by the Government with the proviso that all of the money would have to come from private sources. The proviso was met by plan under which the Government will reduce its share holdings in the company from 80 per cent of the total share issue to 55 per cent. It was reported in February that the company already had spent Y.90,000,000 from its undivided profits fund for expansion of equipment.

Under the abnormal conditions which have prevailed for almost two years, steel prices have almost broken away from the grasp of control agencies. Steel plate ($4' \times 8' \times \frac{1}{2}''$) averaged Y.110.67 in March, 1936, rose to Y.303.33 in March, 1937, and to Y.405 in March, 1938. The gains over 1936 were approximately 200 and 300 per cent, respectively.

Pig iron was kept better in hand, perhaps because its production is concentrated in the Government's company. Wanishi No. 3 pig iron rose from Y.53.77 in March, 1936, to Y.63.20 in March, 1937, and Y.88.50 in March, 1938. Gains on 1936 were 15 and 60 per cent, respectively. After jumping from Y.63.20 in March, 1937, to Y.87.97 in April, the price was throttled back to Y.85.50 in May, permitted to go to Y.88.60 in July and then held steady at Y.88.50 beginning in October.

Higher prices and capacity productions (except for 30 per cent curtailment of the output of round bars unneeded for military purposes) swelled the profit accounts. Despite increases in capitalization, combined earnings of the 11 major iron and steel companies in 1937 aggregated Y.140,000,000, increasing Y.51,000,000, or 57 per cent, over the year before. Dividends were held down in most cases, with much of the profit going into reserve funds for reinvestment in plant.

Principal control measure adopted in 1937 was the Iron and Steel Industry Law, which was introduced into the Diet on March 6, calling for important revisions of the existing Iron Industry Encouragement Law. Under the revisions, the Government extended various privileges to enterprises utilizing poor iron ores and iron sand, such privileges including exemption from income tax, business profit tax and import duties on machinery.

Authority Complete

The law set up a licensing system under which new producing companies must obtain permission to organize. Minimum capacity for new firms was fixed at 100,000 metric tons annually.

Authority of the Government over the detailed operations of the industry was made complete, the State being empowered to issue orders relating to the volumes of production, the alteration of sales prices and terms, and the distribution of the output.

Under a section of the new law, the Iron Industrial Investigation Commission (Seitetsu Jigyo Iinkai) was set up as a consulting body for the Government.

With this law on the books, the Government left control apparently in the hands of the industrialists themselves. Principal development in this form of autonomous control was the organization in 1937 of the Japan Steel Materials Sales Association and joint sales associations for various steel products. Already existing sales cartels, such as the Kwanto Steel Materials Association and the Angle-Steel Sales Association, were generally restricted in some way, usually geographically. The new sales cartel system swept away the restrictions.

The sales control system was well-nigh completed in 1937. The Japan Steel Materials Sales Association was founded in October to supervise all of the smaller sales organizations devoted to individual classes of products. The central body was charged with regulating the supply, distribution and prices of steel materials and of mediating in disputes among the lesser organizations.

Uses Restricted

Although control over the wholesalers was not consummated, a plan was drafted for early adoption.

As an organ for joint purchases of scrap iron, the Scrap Iron Joint Purchase Association was formed by importers and steel companies. Activity of this body was extended to the purchase of domestic scrap in December, when the name was changed to the Scrap Iron Round-Table Conference (Kudzu Tetsu Konwakai).

Immediately after the outbreak of the China incident, the Anti-Profiteering Ordinance was promulgated, followed by adoption of a quota system for the distribution of iron and steel products and restriction of the use of steel materials. The former aimed at giving priority to military requirements. The latter came in the form of the Regulations for Licensing Construction of Iron and Steel Structures, issued as an ordinance by the Ministry of Commerce and Industry. The regulations required that Government permission be obtained for the use of more than 50 metric tons of iron or steel for construction purposes.

Restriction of civilian consumption of iron was intensified commencing on May 15, 1938, by new regulations banning the use of iron in the manufacture of about 50 common commodities, including such articles as paper-weights, inkwells, kettles for the tea ceremony, scissors, strong boxes and wastepaper baskets. It was contended that other materials could be substituted for most of the articles.

More intense efforts to save and to recover iron are in prospect.

BUSINESS RESULTS OF IRON AND STEEL COMPANIES IN 1937

Companies	*Profits (In Y.1,000)*	*1st half Profit Rate %*	*Dividend Rate %*	*Profits (In Y.1,000)*	*2nd half Profit Rate %*	*Dividend Rate %*
Japan Iron	41,496	23.0	7.0	44,569	24.7	7.0
Japan Steel	7,145	41.1	12.0	9,840	79.6	12.0
Kokura Steel ..	1,122	30.0	12.0	1,792	40.8	12.0
Tsurumi Iron.. ..	4,886	39.0	12.0	5,793	43.4	12.0
Azuma Steel ..	1,318	82.4	35.0	1,598	70.1	20.0
Miya Steel	446	63.0	15.0	1,405	145.4	15.0
Nakayama Steel ..	4,478	79.0	8.0	4,054	45.0	10.0
Kobe Steel	1,901	19.0	9.0	2,390	18.0	9.0
Nisso Steel	307	29.2	12.0	820	39.4	12.0
Amagasaki Steel ..	792	84.5	20.0	2,702	201.1	50.0
Tokai Steel Industry .	676	60.1	13.0	425	37.7	10.0
Total	64,567	27.1	14.0	75,388	30.8	16.8

New Canals in the U.S.S.R.

(*Continued from page 275*)

this great work was completed is an eloquent tribute to its builders and their mastery of the use of mechanical aids to construction. Premiums were given for inventions and rationalization proposals. Hundreds and thousands of people learned trades as concrete workers, excavator operators, and the like in the course of its construction.

A special fleet of 183 boats was built for the canal. About 600 engineers and technicians, a service staff of 939 persons, 308 captains, assistants, mechanics and pilots, and 1,960 other marine specialists are employed on the canal. A large number of seasonal workers are also employed. The institutes of the People's Commissariats for Water Transport, Heavy Industry and Communications provided the main engineering and technical personnel; the leading navigation staff was selected from among the most prominent Stakhanovites of river transport; other selected workers were sent to a special two-month course in signalling, navigation and so on, at a school which was established by the Canal Administration near Moscow.

One Hundred Years of Russia's Railways

By F. RAYNAR WILSON, in "The Engineer"

THE first recorded association of anything appertaining to railways in Russia appears to be an indirect one, but it is one that may have played its part when the time came for the building of the first line. Mr. J. G. H. Warren, in his "A Century of Locomotive Building," states that in 1812 the Grand Duke Nicholas, the third son of Tsar Paul I, visited England, and one of the items of interest seen was a Blenkinsop locomotive at work. Other references give 1816 as the year in which the Grand Duke first visited England, when on the *grand tour* and as a young man of twenty, but whatever the year a model of one of these locomotives was subsequently sent out to him. A number of years was to elapse, however, before the idea of a railway in Russia was conceived; for one thing, the Stockton and Darlington, and the Liverpool and Manchester railways had to prove that such ideas were practical possibilities before Russia attempted the experiment. When a railway was first mooted in 1835 the young man, who had unexpectedly become Tsar Nicholas I, is said to have given every encouragement to its introduction.

This first railway was built under private enterprise from St. Petersburg to Pavlovsk, a distance of 17 miles, and on the route was a station at Tsarkoe-Selo, where the Tsar had a country palace, and the line became known as the Tsarkoe-Selo Railway. The construction of a single track was commenced in May, 1836, and the line was opened for traffic towards the end of 1837. The engineering was supervised by Franz Gerstner, a Czech, who obtained all the materials from England. The track gauge chosen was 6-ft., but later the standard gauge became, and remains, 5-ft. It is said that this gauge was chosen for military and strategic reasons, but the wider gauge has permitted more liberal measurements of the rolling stock, and a consequent increase of space in passenger coaches favorably commented upon by different visitors to the country. The first three locomotives were supplied by Robert Stephenson & Co., Timothy Hackworth, and Tayleur & Co., respectively. During their tests in England it is reported that the Stephenson engine exceeded a speed of 65½ m.p.h. and the Hackworth engine 72 m.p.h. Such possible high speed, however, would appear to have been wasted on such a short line, and at no time have the Russian railways been remarkable for rapidity. The locomotives were not used for the opening, and horse traction was employed until April 17, 1838, when a regular service with steam locomotives was introduced. It was not until 1876 that the line was double tracked.

Runs in Straight Line

The results from this railway appear to have given sufficient satisfaction for a more ambitious scheme to be undertaken, viz., a line from St. Petersburg to Moscow, a distance of about 400 miles. This line runs in almost a straight line, and the reason is—or, at one time, was—well known. When the Minister of Ways and Roads laid the map before Tsar Nicholas to explain the proposed route, about which there had been some heart-burnings, the latter, after looking at the map, took up a ruler, drew a straight line between the two towns, and commanded "You will construct the line so." Such a command permitted no argument, and the line was built accordingly. Construction began in 1842. The probable disadvantages of the route in the earlier days of the railways must have changed to a considerable advantage in more recent years. The line was completed in 1851, and in the same year the telegraph was erected alongside it.

These two lines remained the pioneers for some years, and it was not until after the great political changes in Russia following the Crimea War, which included the emancipation of the serfs and the creation of a new system of local self-government, that any impetus to railway development occurred. An empire of enormous size, both in Europe and Asia, it was mainly devoted to agrarian interests, and manufacturing industries were in a backward state. Its mineral wealth was practically unknown, and the first region to be developed in this respect was the provinces north of the Crimea and the Sea of Azov, where vast quantities of iron ore and huge beds of coal were found to be in close proximity to each other, but it was some time before railways were to operate in that area.

On May 18, 1853, the Riga and Dunaburg Railway was established by special decree of the Tsar, and the project was mainly financed in England with a London board of directors. The capital was £2,000,000, of which 3,000 shares of £100 each were to be reserved for Russian shareholders. The Russian Government gave a guaranteed interest of the equivalent to 5 per cent, and other valuable privileges, and the concession was for seventy-five years. Mr. (afterwards Sir) John Hawkshaw was appointed engineer-in-chief, and Robert Stephenson & Co. supplied the locomotives. The line was 140 miles long, and was eventually opened for traffic in 1861. An extension from Dunaburg to Witepsk was granted under the concession of the Tsar in March, 1863. This railway was taken over by the Government in 1894.

Finland's First Railway

The first railway in Finland was between Helsingfors and Tavastehus, a distance of 65 miles, commenced at the instance of Tsar Alexander II in 1857 and completed in March, 1862, at a cost of about £589,000. In 1870 a line from St. Petersburg to Rühimaki was opened, the cost of constructing the 235 miles being £1,100,000. By 1891 there were over 800 miles of railway in the territory, and further construction was in hand.

When further railway extensions in Russia were projected it was arranged that the construction and operation should be undertaken by private enterprise, and that such companies would provide the necessary capital, whilst the State would guarantee the interest. About 1858 concessions were granted to English and French investors, mainly represented by the Credit Mobiliere of France, for the construction of the following lines, with lengths in miles:—

	Miles
St. Petersburg to Warsaw	670
Kovno branch	60
Moscow to Nijni-Novgorod	280
Moscow to Sebastopol	933
Little Archangel to Libau	750
	2,693

The estimated cost was in the region of £45 million. The agreement provided that 200 miles were to be completed by the third year from date of commencement, 666 miles by the end of the fifth year, and the whole of the lines at the end of ten years. The lines were to be double-track, but the companies were permitted to commence operation with one line only laid down. At this period there were about 700 miles of railway in Russia, and in the following ten years the amount had increased to over 2,400 miles, whilst by the end of 1872 there were nearly 4,300 miles of line.

An official return, made at the beginning of 1876, stated that there were 12,144 miles of line, with 2,829 locomotives, 5,112 carriages, and 48,614 wagons. The outlay of capital on their construction and equipment was £190,773,011, and the debt of the various lines to the State amounted to £10,289,825. Of the capital used on the Russian lines, about £80 million had been raised by shares, and the balance by obligations. Some of the lines had proved very remunerative. The Moscow-Riazan had earned 18 per cent per annum on its capital, and the Riazan-Koslov 14 per cent, but these seem to be the exception rather than the rule, as the Russian Treasury had to pay about 28 per cent of the whole amount guaranteed. There were fifty-three companies operating the railway systems.

Further particulars, issued in October, 1888, show that the lines opened for traffic amounted to about 18,228 miles, of which about 3,082 miles were operated by the State. A few small railways, although owned by the State, were worked by private companies. The revenues for the years 1887 and 1888 were good, owing to exceptionally fine harvests. The average net profit for the ten years

1878-87 was approximately £7,600,000, and for 1888 £12,350,000. The aggregate working expenses of the whole railway system were 56 per cent. The policy of the State in taking over the private railways was rapidly extended, and by 1900 about 60 per cent of the total were national.

Prior to 1885 there had been no railway communication between European and Asiatic Russia, but in that year there was an extension of the railway from Ekaterinburg to Tiumen which provided a partial solution to the difficult problem of transportation across the Urals. A few years later plans were prepared for the construction of a railway across Southern Siberia to Vladivostok. This was not the first railway in Asiatic Russia, as a line from Krasnovodsk, on the east coast of the Caspian Sea, to Samarkand had been in operation from 1888. A single track main line, 5-ft. track gauge, was planned to be built in three main divisions :—(1) Western Siberia, from Cheliabinsk, on the Ural frontier, and connected by rail to Ekaterinburg, to Novo-Nikolaevsk on the river Ob, a distance of 885 miles, which was completed and opened for traffic in 1895 ; (2) Central Siberia, from the Ob to Irkutsk, a distance of 1,150 miles, commenced in 1893 and opened for traffic in 1898, and an extension from Irkutsk to Lake Baikal was opened later the same year ; (3) Eastern Siberia, from Lake Baikal to Vladivostok, the route for which was not finally agreed upon for some time. The Tsarevitch, later to be Tsar Nicholas II, turned the first sod at Vladivostok, as he happened to be paying a visit to the East at the time, and was appointed President of the Imperial Committee of the undertaking in 1893, the year before he succeeded his father as Tsar.

Work Proceeded Westerly

The work in Eastern Siberia proceeded in a westerly direction, materials being landed at Vladivostok. Negotiations with the Chinese Government eventually resulted in 1896 in the organization of the Chinese Eastern Railway, which undertook to construct a direct line across Manchuria, from a town of that name on the frontier to connect with a branch of the Vladivostok-Khabarovsk line, at a point on the eastern boundary of Manchuria north-west of Vladivostok, a distance of 1,080 miles. This line was linked up with the railway, commenced in 1895, being built from the eastern shore of Lake Baikal. For some time a car ferry service was maintained across Lake Baikal, until a section of 200 miles of railway along the southern shore of the lake was completed in 1904. This work had been deferred on account of the heavy engineering works involved, and represented the most difficult section of the whole line, for thirty-three tunnels of varying lengths had to be made. During the twelve years of construction 3,780 miles of track were laid by Government engineers at a cost of about £42 million, including provision of rolling stock, and an additional £10 million was added for improvements in equipment. The line was through country practically undeveloped, and many bridges had to be constructed along the route. In 1906 it was decided to build a line entirely through Russian territory, starting from Karimsk, where the junction to the line connecting the Chinese Eastern Railway was to be made, and following a route within a distance of from 10 to 80 miles north of the river Amur to Khabarovsk. Construction was commenced in 1908, and the work was completed in 1915. The length was approximately 1,240 miles, and several small branch lines have been added later. The distance from Moscow to Vladivostok is 5,542 miles, and the railway was subsequently double-tracked throughout.

In 1914 the railway mileage was about 35,000, and there were 20,320 locomotives and 500,000 wagons. Yet for the size of its territory Russia was ill-served by railways, there being about 11.3 kiloms. for every 1,000 square kilometres in Russia and about 0.6 kilom. in Asia, and it cannot be said that the railway organization was good. The period covering the war and civil upheaval during the following years can receive no attention, and is merely mentioned because there followed the formation of the Union of Soviet Socialist Republics, which, whatever the colour of one's politics, must be regarded as one of the world's greatest experiments in the planning of the so-called " ordered national economic life." The difficulties were truly tremendous, for within the European and Asiatic territory there were about 160 million persons of nearly 200 races, and with a multiplicity of languages. The need for efficient communications became extremely vital, and as, during the upheaval, about 25 per cent of the track and 7,762 railway bridges had been destroyed, and a great number of railway stations had been burnt down, whilst the rest of the remaining systems was badly disorganized, the task of bringing the railways to a standard comparable to that of pre-war days was no easy one. The whole of the country's transportation was at first controlled by the People's Commissariat of Transport, but in 1930 a separate Commissariat for Railway Transport was established, and, like other Government departments, was centred at Moscow. The authorities aimed at a modern system and introduced improvements from abroad in equipment and operation, and at one time it was estimated that a quarter of the Soviet budget was spent on the transportation facilities of the country as a whole.

Principal Scheme

In 1927 the total mileage was about 46,300, but the track and equipment were in poor condition. The first piatiletka (five-year plan) was put into operation on October 1, 1928, and was practically completed by the end of 1932. The railway scheme provided for the permanent way, rolling stock, and general operation of the existing railways to be brought up to a good standard, and certain new lines were authorized for construction. About £500 million (computed on a par basis) was made available, of which £330 million was to be spent on reconstruction and new equipment for existing lines. Arrangements were made for equipping all coaches with automatic brakes and half the freight vehicles with automatic couplers. A beginning was made on the installing of automatic block signalling in 1931, and a commencement was made with the electrification of certain lines. Larger and more powerful locomotives were built, and 2,729 of these were put into service.

The principal scheme for new railway construction was the Turkestan-Siberian (Turksib) Railway, running from Semipalatinsk, on the Trans-Siberian Railway, then being developed into a large manufacturing center, to Pishpek (since renamed Frunze), in Eastern Turkestan. The work involved many engineering difficulties, but opened up a country giving great possibilities for development. The length of the line is a little under 900 miles, and work was started from both ends in 1927 and completed in 1931, at a cost of about £20 million, not including the rolling stock. Another important line built was between Orenburg and Tashkent. To facilitate movements of traffic the number of double-track lines was increased, and by 1933 of the entire railways 23.2 per cent had become double track.

The second piatiletka (1933-37) provided for a more ambitious programme, and it is estimated that about £1,750 million will have been spent on railway works during that period. Of this amount, £1,000 million was to be spent in reconstruction and extension of existing lines, £270 million on new construction, and the remainder on capital repairs, renovations, and buildings. At the end of the first piatiletka there had been installed 582 kiloms. of automatic block signalling, by 1934 this total had been increased to 2,579 kiloms., and it was expected that the amount would be 8,300 kiloms. by the end of last year. The number of locomotives at the end of 1932 was about 19,500, and this was to be increased to 24,600 before 1938.

Included in the new lines for construction are the Baikal-Amur, approximately 950 miles, the Akmolinski-Kartahi, approximately 500 miles, the Moscow-Donbas (Donetz River Basin), Karganda-Balkhash, and Ufa-Magnitnaya lines, which will be mostly double track, totalling about 10,000 kiloms. A heavier type of rail has been introduced, weighing 44 kilos. per metre, or approximately 90 lb. per yard. Double tracking of existing lines is being extended, and eventually there will be three double-track lines from the center to the east, instead of three single-track lines, whilst there will be four double-track main lines from the center southwards, and one double-track main line from the Donbas onwards.

First Electrified Line

The first railway line to be electrified in Russia was between Sabunchy and Surakhan, in Baku, in 1926, when 1,500-volt D.C. overhead conductor wires were adopted, and the same system was used for the Moscow-Mytischy and Mytischy-Bolshevo lines when electrified in 1929. In 1932 a beginning was made with the electrification of the main lines, when lines in the Suram district in Trans-Caucasia and the Kisel-Chusov line on the Perm Railway were electrified. By the end of 1934 there were 379 kiloms. of

electric railways, of which 203 kiloms. were suburban and 176 kiloms. main lines. A number of main lines in the principal areas of the Soviet Union are to be electrified, and the scheme in hand provides for 6,161 kiloms., of which 4,421 kiloms. are to be completed by the beginning of 1938. The Moscow underground railway was begun in 1932, and the first section, 11½ kiloms. in length, was opened in May, 1935. The underground system will consist of twelve lines with a total length of 80 kiloms., and its construction and equipment incorporate the latest ideas. The whole of the work was carried out with Soviet-manufactured materials and labour, but expert foreign advice, including that of the London Passenger Transport Board, was used in determining the methods to be adopted.

Following various disputes with the Chinese Government over the Chinese Eastern Railway, and subsequently with the Japanese Government when the latter formed the Manchoukuo territory, a Soviet-Manchurian conference was held in Tokyo in June, 1933 to discuss the sale of the railway. Little progress was made during the discussions, but on March 24, 1935, an agreement was signed between the Soviet Union and the Japanese Government for the sale of the railway to the latter for 140 million yen (approximately £14 million), which amount did not include the amount of about 30 million yen to be paid as compensation to those Soviet employees released from service.

By the end of last year it is estimated that there were 94,000 kiloms. of railway, and that 24,600 locomotives were in service. The average number of persons employed on the railways now reaches the total of 1,300,000, and facilities have been established for the staff to receive a thorough training in railway subjects. There was an alarmingly large number of railway accidents at one time, but with the improved appliances installed and better training of the staff a decided improvement has been effected. Heavy traffic movements are reported over the whole railway system, and with the large schemes of industrialization throughout the country this is only to be expected. Owing to the financial complexity it is quite impossible to arrive at any conclusion as to the financial results from the operating of the railways, and this state is likely to continue for some time.

Bhavnagar, India's Newest Port

(*Continued from page 260*)

One matter of concern was the mooring of the vessels subjected to a tidal variation as high as 40-ft. It is obvious that unless some provision were made, a gang of men would be required to remain on duty practically constantly adjusting the lines of the vessel, where the elevation varies as much as 7-ft. in an hour.

Consequently, there was designed a contrivance called, for want of a better name, a Mooring Stabilizer. These will be installed in addition to ordinary bollards, which will be used during unusual weather conditions, and they will be placed at intervals of approximately 100-ft. along the face of the wharf.

This stabilizer consists of a simple vertical slot running from the deck of the wharf down to an elevation of 10-ft. below low tide. They are very simple in design and are built up of steel plates and Z bars. The slide in the slot is constructed of plates to which the mooring ring is fastened, and to which the ship's lines are attached. This slide is always kept 2 or 3-ft. above the surface of the water by light steel tanks which support it and which slide up likewise, attached to the slot. This keeps the ship's lines automatically at the same tension and relationship to the mooring, irrespective of the elevation of the water.

The detailed surveys—topographical and railway—as well as all the drafting work, were done by native engineers, for the most part graduates of the various Indian institutions.

The estimated cost of this initial major program to be undertaken by the Bhavnagar State is slightly in excess of one and one-half million dollars, and it is felt that on account of the above mentioned unique features, it will present a very interesting example of modern port development in the Orient.

Interesting deviations from the tentative plan originally contemplated have been found necessary by Mr. Moorehead. The channel slope was figured on the three to one basis with protection levees set quite a distance in the rear to allow a berm in case the material did not prove practical at this slope, and actual experience has found that the slope is approaching a one to four or one to five angle.

In spite of the borings which were taken for the deeper portion of the turning basin, clay bolders and hard pan were encountered which interfered with the driving of the piling, and consequently, as a lack of sufficient penetration was obtained, a short bulkhead 5-ft. high is being placed along the face of the jetty, made up of precast sections bearing against piling, in order to hold the toe of the slope of rip-rap which will be filled in to a corresponding depth around the piling and up the slope.

The content of silt is quite heavy in the turning basin, and experiments have been carried out by Mr. Moorehead with a view to ascertaining the practicability of a shore-pumping plant with fixed pipe of 40-ft. centers for the purpose of eliminating at a minimum expense the major portion of the silt from the deep section of the turning basin.

A power plant has been constructed about 3½ miles from the port for the purpose of supplying electric power, and adjacent thereto a water well has been sunk, and a tower 100-ft. high, holding 100,000 imperial gallons, has been constructed for obtaining the necessary storage and pressure.

The formal opening of the new port took place in the latter part of 1937.

Formosa's Hydro-Electric Power Station

(*Continued from page 269*)

the generator is effected automatically by means of the water-level indicator in dependence on the water-level of the intake.

Shutting Down the Machine Unit

The load is reduced by controlling the speed adjustor from the switchboard, until the indications of the wattmeter and reactive volt-ampere meter are zero. By moving the drum controller to position 6 the guide vanes and, thereafter, the throttle valve are immediately closed. At the same time the oil circuit-breaker and the automatic field weakening device trip, and the alternator is de-excited and is disconnected from the line. The speed adjustor returns automatically to its starting position. Signal lamps on the switchboard indicate when the turbine is again ready for starting up. The entire automatic operating system can be switched off by the turn of a rotary switch. The principal parts of the plant can then be controlled manually, or by individual operating switches.

After a short trial period, the Water Power Plant Suiriko was taken over by the Japanese authorities at the beginning of September 1937, and has since been working to their entire satisfaction.

Stabilized Asia and American Cotton

(Continued from page 254)

now under the temporary curtailment made necessary by the hostilities. Concluding, the writer says:

"Would it be better long-run business for the United States to have the notes of Japan's cotton spinners and weavers, payable over a term of years and guaranteed by the Bank of Japan or similar institutions—with a million bales of American cotton moved into consumption and the producers paid off—than for the United States government to hold an equal sum in non-recourse notes of producers, with the cotton impounded as a threat against the future?"

Concrete in Japanese Railway Construction*

Reinforced Concrete Gradually Taking Place of Steel as Basic Material in Nation's Expansion of Railroad Network

By FUKUJIRO HIRAYAMA, Director of the Construction Bureau, Railway Ministry of Japan

THE Government Railways usually buy cement in quantities and supply it to firms engaged in the construction of railways and their adjunctive structures. In parallel with the expenditures, the quantity of cement varies, naturally. The largest quantity was bought in the beginning of the Showa era, the year being 1929 and the quantity, 5,700,000 bags. The quantity of cement increased greatly in comparison with the expenditure during the Showa era, as against figures for the Taisho era. This tendency can be attributed chiefly to the fact that the utilization of cement has become an important factor in railway construction.

Portland cement is used most widely, but blast-furnace and high grade cement also are used for certain constructions. Cement is one of the most important materials, next to steel and iron, in railway construction. Bricks and stones of olden times have been almost entirely discarded now, although the use of cement has not a very long history behind it. Cement replaced bricks and stones about the beginning of the Taisho era (1912), and with the coming of reinforced concrete, cement replaced even some steel. The chief railway structures are bridges, culverts, tunnels and ground-walls.

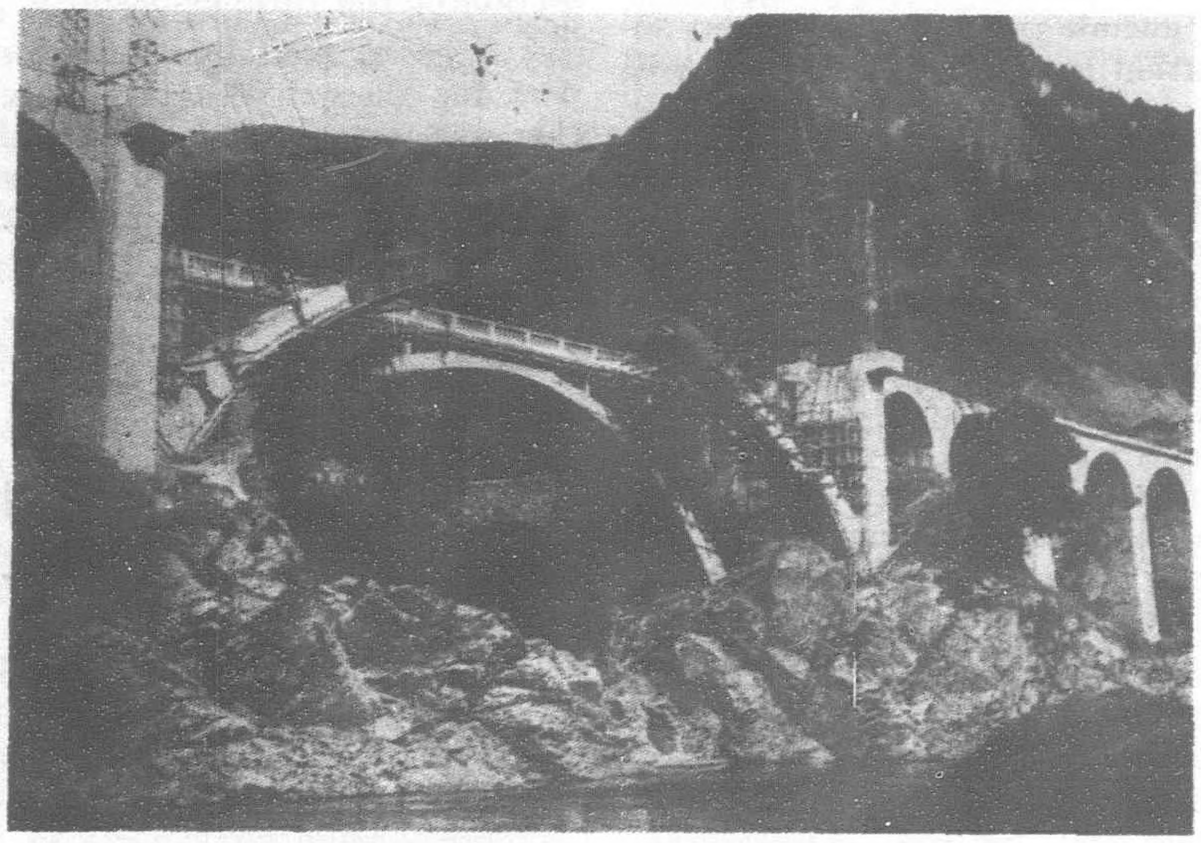


Photo 1.—The reinforced concrete bridge at Tsunanose on the Hinokage line, Kyushu, showing the cable section and arch in the course of construction

Bridges

Bridges can be divided into three parts, viz: abutments, supports and girders. The first two are again divided into foundation and main body. Even in the days of bricks and stones the foundations were of concrete—what is termed foundation concrete. Discarding bricks and stones, the main bodies were made, as to-day, wholly of concrete, as early as the end of the Meiji era (1912). This revolutionary type of construction was first attempted on the Oita-Kumamoto lines, Kyushu. Started in 1912, the work was completed in 1917, abutments and supports of the bridges in these lines being wholly made of concrete. The Oita Construction Office, the head of which was Dr. Naha, was in charge of the work. The same office also used concrete for several bridges on the Oita-Saegi line as early as 1912-1915.

Special mention should be made of three bridges on these lines: one spanning the Ototsu river, 70 feet long and having seven steel girders; the second over the Ono river, 70 feet long and with 13 girders, and the third over the Tsukumi river, 50 feet long and three girders. All of these bridges have foundations of concrete instead of brick and stones. They were the first bridges to be built with concrete. On the Oita-Kumamoto line, the Kobukari river bridge, a right oblique angle of 30 degrees, 15 feet in diameter and, with seven steel girders, and the Asami bridge, a right oblique angle of 30 degrees, 15 feet, seven girders, the "Torii"-shaped supports of reinforced concrete have been planned, being the forerunners of such structures.

Reinforced concrete structures worthy of note in this period are the Yatsuyama bridge and the ground-walls at Shinagawa on the Tokyo-Yokohama line, which were completed in 1913-14. The walls have supporting walls and a shelf comprise one of the boldest plans attempted at that time. When concrete was first used, bricks, stones and even concrete blocks, instead of wooden forms were used as moulds. These early methods are almost entirely out of fashion now, except in very special cases.

Concrete became really popular about the beginning of the Taisho era, the Government Railways standardizing the specifications for the use of cement, such as "steel girders and concrete abutments and supports," "Non-reinforced concrete arches up to 20 feet in diameter," "Reinforced concrete culverts and girders up to 10 feet in diameter with concrete abutments," and "Concrete well-shaped foundations," etc. These have been sent to all construction offices for the purpose of standardizing their work.

The advantages of concrete construction thus were recognized, although reinforced concrete works was not yet popular, being limited tc the construction of culverts and other structures mentioned previously. But the advantages of reinforced concrete could not be long denied.

Reinforced Concrete

In 1914, plans for standard reinforced concrete structures were issued by the Government Railways. The use of reinforced concrete was most active between 1915 and 1919, the best instance being the elevated line built between Tokyo and Manseibashi Stations. The first part, between Tokyo and Gofukubashi, planned by a German engineer, was of brick arches. In contrast to this method, the rest has been built of reinforced concrete, except at street crossings. Arches and girders are of reinforced concrete and the foundation of concrete piles. This project is outstanding as

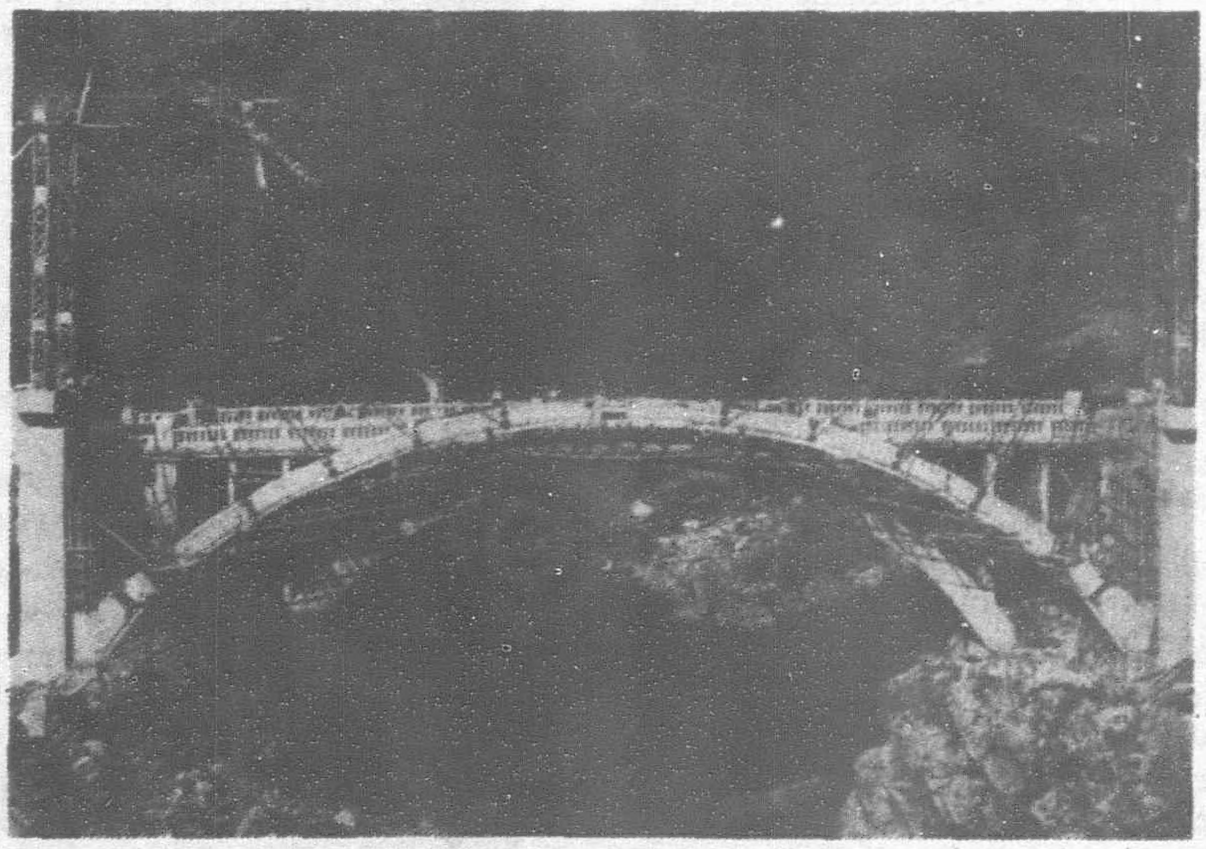


Photo 2.—Another view of the Tsunanose span

*In the *Japan Times*.

the first large-scale reinforced concrete work. It was instrumental in the consequent building of the Tokyo-Uyeno, Osaka and Kobe elevated lines.

In special projects, such as elevated railways, much use was made of reinforced concrete as early as 1912, although for general construction of bridges it was introduced sometime later. In the construction of new lines, particularly, reinforced concrete was little used.

During the World War, all construction materials became scarce and expensive. Nevertheless, there seemed to be little scarce effort to replace steel materials with the cheaper and plentiful reinforced concrete at that time. This is strange when one considers the efficiency of the latter material, the use of which on the elevated railways had already proved a success.

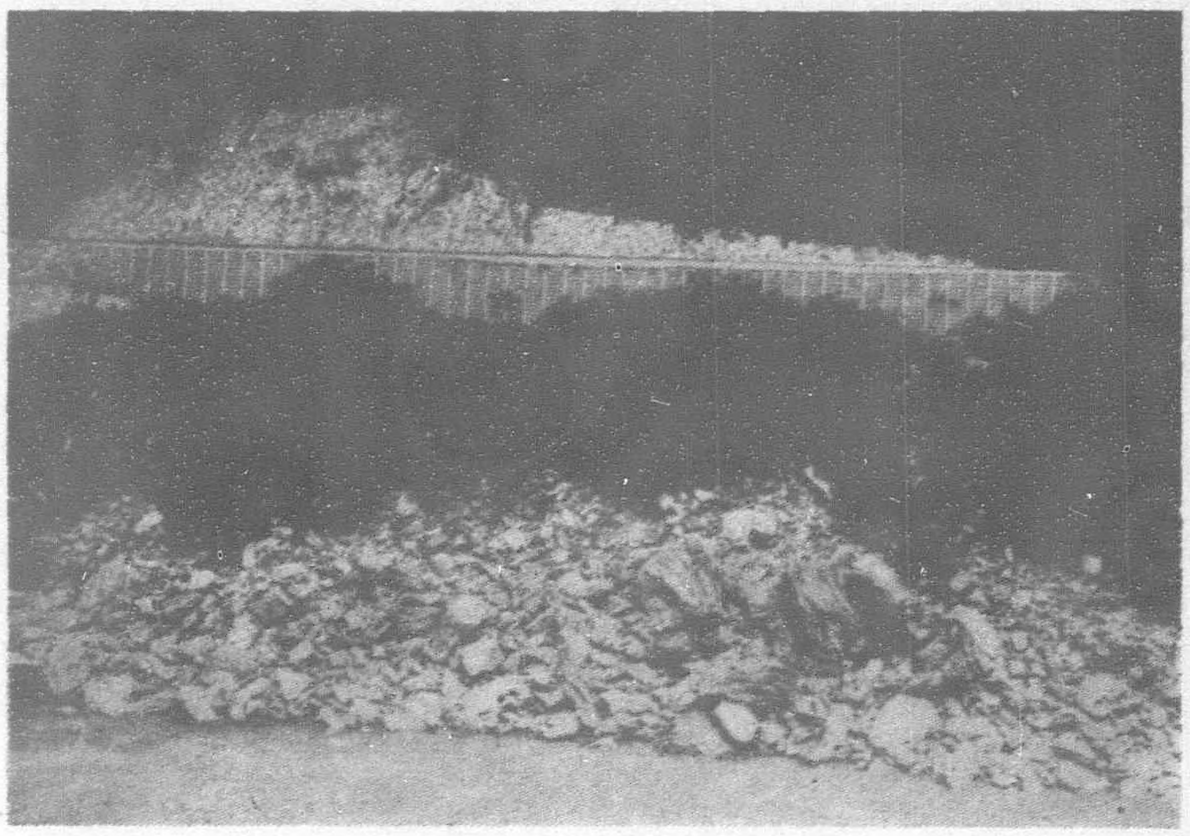


Photo 3.—The Tosan line in Shikoku, showing special ground walls in which blocks of reinforced concrete have leen laid cross-wise

Reinforced concrete structures were late in coming into vogue on newly-constructed lines. This material was used mostly in culvert work at first. The Yamaoi bridge on the Boso line was constructed of reinforced concrete in 1924, the reason being that as the line runs along the seashore, steel would not be durable.

Reinforced concrete is used in the place of steel and instead of non-reinforced concrete. In railway construction, most bridges are of steel but it has been found that reinforced concrete is just as good. In the country, where such materials as brick and stone entail transportation difficulties, sand and pebbles always can be relied upon, hence the use of cement.

Concrete Girders

The first concrete girders were reinforced concrete slabs to replace "I" shaped steel girders up to five meters, next "T" shaped concrete girders appeared in the place of steel girders up to 12 meters. These slabs and girders were used singly first, and later in series. While the use of reinforced concrete started on short bridges, it naturally spread to longer ones. To-day bridges 50 meters long are built by this method. Concrete being much heavier than steel, the state of the ground imposes certain limitations, particularly as railway bridges have to bear more weight than the ordinary bridge.

There are still many ways in which reinforced concrete may be successfully employed. The present China Incident has enforced economy in the use of steel, and many structures usually of steel may now be built of cement.

Photos 1 and 2 show the reinforced concrete bridge at Tsunanose on the Hinokage line, Kyushu, showing the cable section and arch in the course of construction.

Reinforced concrete has replaced non-reinforced concrete for abutments, supports and foundations of bridges. In these cases, the weight is lessened. This is especially advantageous on soft ground. As for the supports, the section is greatly lessened, eliminating unnecessary resistance to the flow of water. In the case of abutments, couch-lever or supporting walls can be planned in the ground walls, increasing the stability.

Tunnel Construction

In tunnel construction, the use of concrete as a surface-covering material was started at the end of the Meiji era, 1912. Early work was limited to covering side walls and parts of arches near the sides, the greater part of the arches being built of brick. Near the entrances and against soft ground, no concrete was used. From 1916 or 1917, concrete blocks began to appear their size being 15 cm. by 23 cm. by 30 cm. Made on the spot, they were fastened together with mortar, the same as bricks. After this, bricks and stones were discarded. In the construction of water power tunnels, concrete mixed on the spot was used over arches and side walls much earlier. The railways used concrete blocks instead until 1929 or 1930. The advantages of concrete mixed on the spot having been proved, the blocks were discarded.

Reinforced concrete has not been used for tunnel construction, except in special cases.

As for the ground walls, the use of concrete is particularly noticeable, although stones are still being used. The chief advantages of concrete, as compared with stones, for ground walls are:

(1) The work of laying is much simpler.

(2) The symmetrical exactude of stone-cutting is no longer required.

(3) Cheap broken stones being the main materials, general planning does not require difficult calculations.

In regions where the supply of stones, even of the broken kind, is scarce, non-reinforced concrete without stones, or reinforced concrete specially designed to meet the purpose, are being used.

Photo 3: The Tosan line in Shikoku, completed in 1934, showing special ground walls in which blocks of reinforced concrete, 15 cm. wide and 1.5 meters or 1.8 m. long have been laid out cross-wise.

Other Uses

Another special use for concrete is the concrete rail-line floors used in long tunnels to lessen the difficulty of keeping the line in a good condition. In 56 tunnels this method has been applied, according to a report made in March. The first was the Fushikobetsu down-line tunnel on the Muroran main line, built in December, 1922.

Tunnels over 1.5 kilometers long on new lines all have concrete floors. The Senyama tunnel (5.36 km.) on the Sendai-Yamagata line, completed in the autumn of 1937, has welded rail-lines over the concrete flooring, the exact result of the experiment has not yet been determined, although the advantage of the carriage-running over such lines is not doubted. In the Usami tunnel (2.92 km.) on the Ito line, under construction at present, welded rails over the concrete flooring also are to be used.

Photo 4. A section of rail-lines over concrete flooring.

Most railway structures such as engine depots are of concrete. Kozu depot, built at the end of the Meiji era, and Naokata depot are also of reinforced concrete.

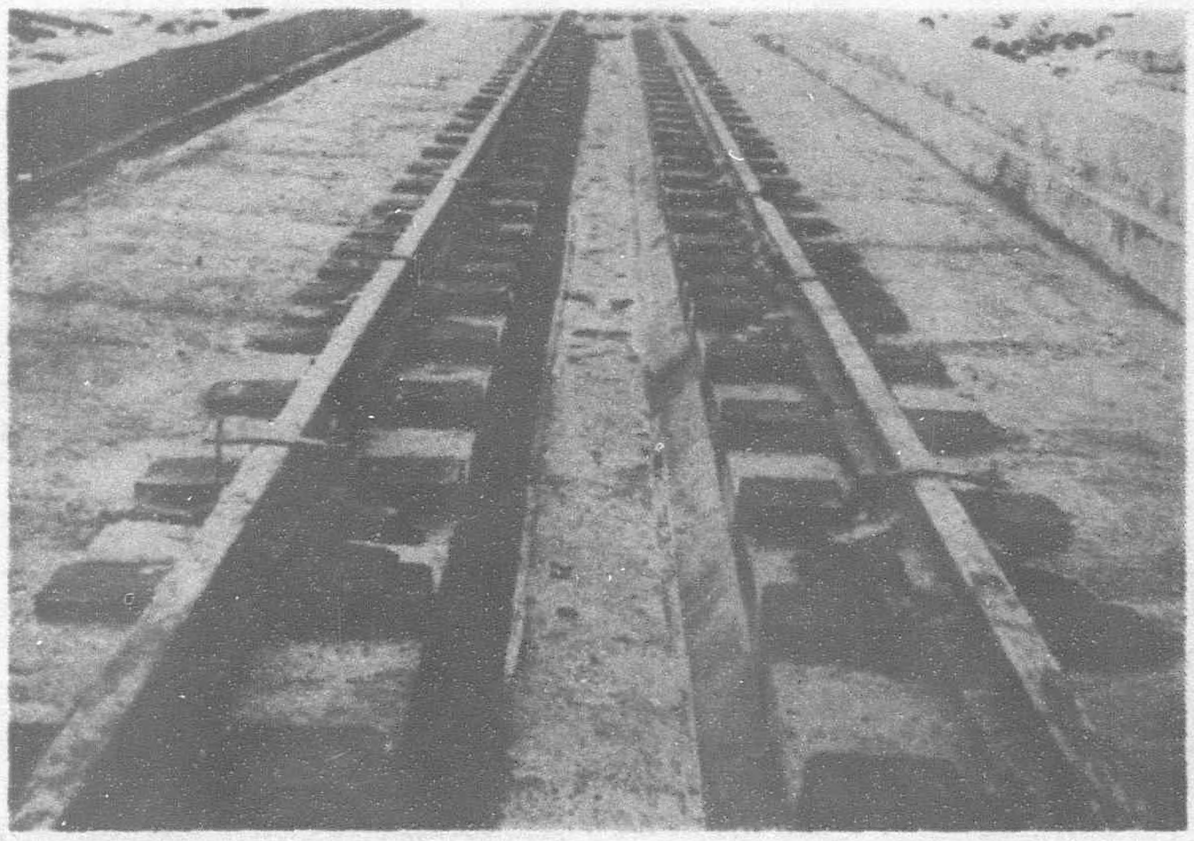


Photo 4.—A section of rail lines over concrete flooring

Engineering Notes

MINING

MINES ARE BOUGHT.—The Manchuria Mining Company has purchased mine lots at Chiapikou in Hwatien-hsien, Kirin Province, from the Tatung Development Company, all formal procedure for transferring the mines were completed at the spot between officials of the Tatung Development Company and Mr. Shimada, president, Mr. Kato, manager, and Mr. Abe, chief of accountant department, in behalf of the Manchuria Mining Company. Full field investigation at the newly acquired mines will shortly be made by the new owners before developing them.

GOLD MINING FIRM TO OPEN.—The inaugural meeting of the Hunchun Alluvial Gold Mining Company, capitalized at two million yen, invested in by Asano and Co., will be held shortly, it was announced in June. The establishment of the projected firm has been sanctioned by the Manchoukuo Government. With its headquarters in Hsinking, the company is to mine alluvial gold amounting to 50 to 60 kan a year in Hunchun-hsien, Chientao Province. Mr. Ryozo Asano will take office as president of the firm.

RAILWAYS

S.M.R. TO INVEST HEAVILY.—The South Manchuria Railway Company will invest 10 million yen in the projected North China Traffic Company, which is expected shortly to be organized as one of the subsidiary enterprises of the semi-Governmental North China Development Company, Mr. Tsuji Miyamoto, Vice-director of the Research Board of the S.M.R. said recently. He indicated that this investment might be made by transferring to the North China Development Company the paid-up shares of the Kochu Kungssu, a subsidiary of the railway concern.

TIENTSIN TRAFFIC COMPANY.—Arrangements are being made for establishing the Tientsin City Traffic Company with capital of two million yuan, subscribed half by the Huapei Motor-car Company and the Dairen City Traffic Company. Bus service in Tientsin is being managed by the Huapei Motor-car Company before the inauguration of the firm for the sake of convenience. The North China Public Motor-car Company under individual management was purchased by the new firm. Application for sanction for the projected firm will be made to the authorities as soon as all preparations are completed.

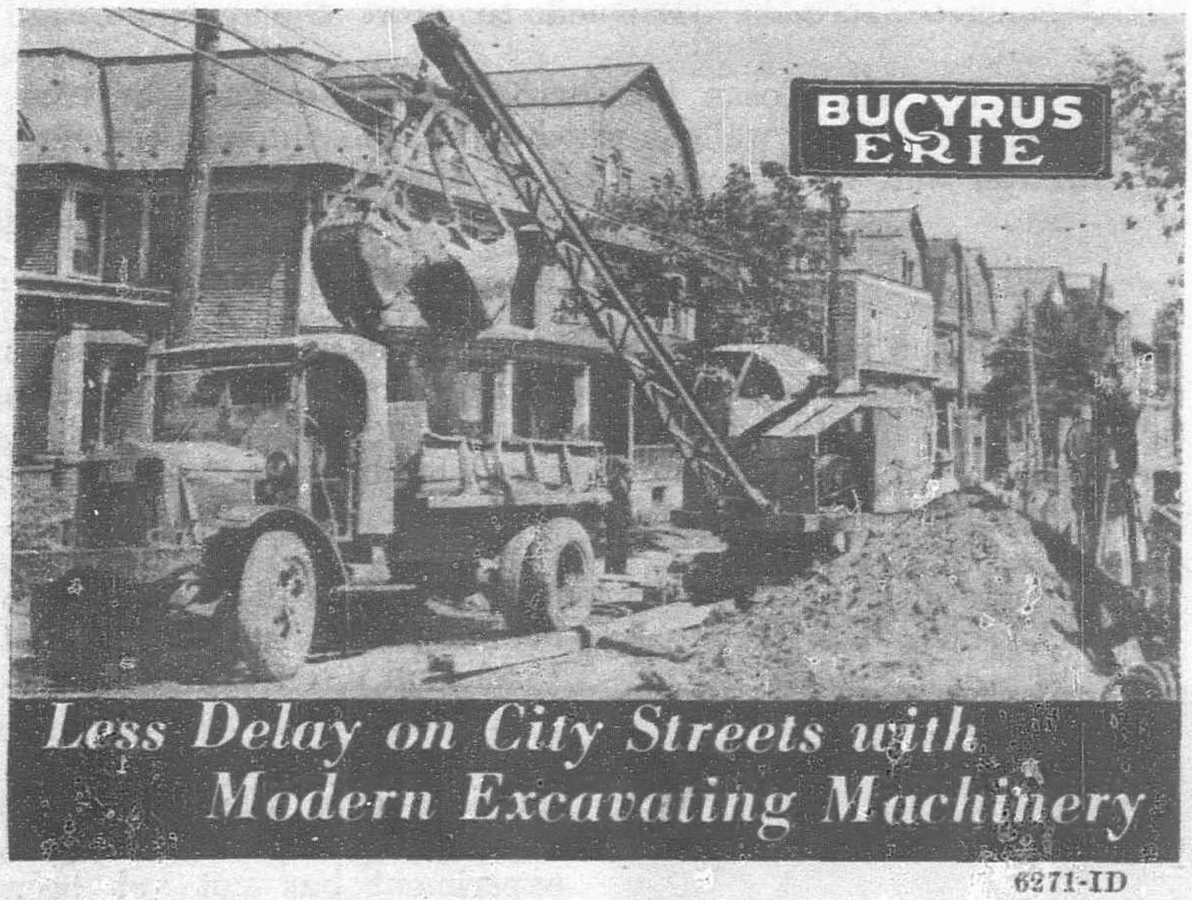
SHIPPING

GOLD MINE SHIPS ORDERED.—With a view to carrying out the five-year plan for increasing gold production to 300 million yuan, the Manchuria Gold Mining Company, which placed an order in Japan to construct eight gold mining vessels some time ago, in order to exploit the alluvial gold mines in North Manchuria on a vast scale, has decided to order eight additional vessels from Japan. The number of vessels owned by the said company will increase to 10 this year and to 18 next year. Each of the 16 vessels will be laid down at a cost of one million yen. If including expenses for taking each vessel to North Manchuria and for various equipment, it will cost some 1.6 million yen. The fund required will be taken from the company's reserve fund and four million yen on loan from the Industrial Bank of Manchou. The plan for increasing the Manchuria Gold Mining Company's capital, which was reported previously, is in abeyance, it is understood.

INDUSTRIAL

MAGNESIUM COMPANY OPENS.—The Manchuria Magnesium Company held its inaugural meeting at the headquarters of the Manchuria Heavy Industry Development Company at Hsinking in July. The company is capitalized at ten million yen, of which a quarter is paid up by the Manchuria Light Metal Manufacturing Company. With its headquarters in Hsinking the new firm is to erect plants at Yingkou, which will produce from next year 1,000 tons of magnesium a year from mineral ore supplied from Tashihchiao. In future the equipment of the plant will be enlarged to produce 3,000 tons of magnesium per year.

MANCHOUKUO PULP PLANTS.—In compliance with the joint plan for increasing pulp production from timber between Japan and Manchoukuo, which was drafted some time ago by the Planning Board of the Japanese Government, the Manchoukuo Government, as a result of deliberations, has decided to establish a corporation, capitalized at 100 million yuan, which is to produce 230,000 tons annually of pulp, the shortage in the quota of 400,000 tons allotted to Manchoukuo. The projected firm will manufacture pulp from timber supplied from the unexploited forest resources in the Large and Small Hingan Ranges. Arrangements will be made by the Manchoukuo Government for investment in the projected firm with the three Federations of Japan Paper Manufacturing, Rayon and Staple Fibre Associations, limiting investors to these Federations.



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